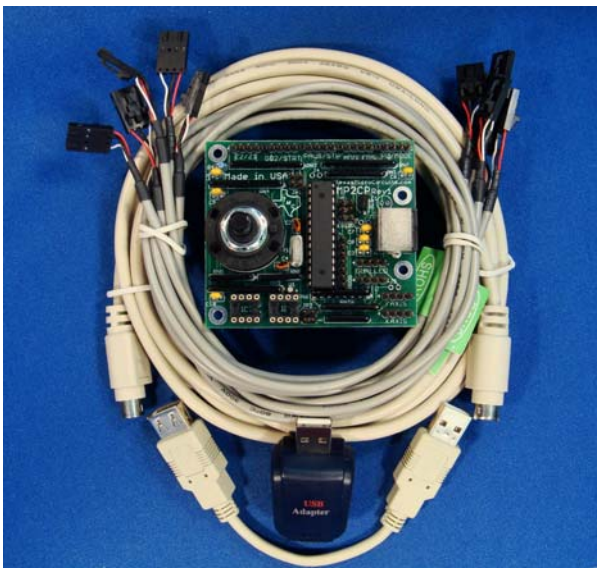
Texas MicroCircuits

MiniPendant 2 Control Processor Control Processor (MP2CP)
User Guide & Kit Instructions

Rev 1.10

Last update: 9/3/2010



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Read This Before You Begin… (The proverbial fine print)

Any computer controlled machine tool is potentially dangerous. You've already accepted responsibility for the operation of the CNC machine you expect to control with the MP2CP. The MP2CP is a device that was designed to replicate the same commands that could be executed from the PC keyboard running the Mach © software.
The Mach © software runs a myriad of different types of machines worldwide. This manual is here to give you guidance on safety issues and proper operation of the MP2CP and associated options. Since we do not know the details of your machine, environment, or operator skill level, we cannot take responsibility for any damage or injury caused by its use. It is your responsibility that you understand your machine, its capabilities, and any safety issues it generates.

If you are in any doubt, be sure to seek guidance from a professionally qualified expert rather than risk injury to yourself, others, or damage to your equipment.

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Texas MicroCircuits is not responsible for any damage to equipment or tools as the result of usage of the MP2CP and/or ZTO devices.

User Guide Overview

This document is a User Guide for the MiniPendant 2 Control Processor (MP2CP) The device is designed and manufactured by Texas MicroCircuits in the USA. It is one member of a proposed family of pendants designed and manufactured by Texas MicroCircuits. A pendant is a remote activation device designed to operate a CNC machine usually tethered by a cable but can be wireless as well. It is primarily intended for an audience that runs the Mach 3 © software but is not limited to such. The MiniPendant 2 Control Processor (MP2CP) is the "kit form" of the proposed pendant family. The MiniPendant 2 Control Processor (MP2CP) operates like a keyboard device emulating the PC/PS/2 keyboard scan codes used by the computer system it is attached to.

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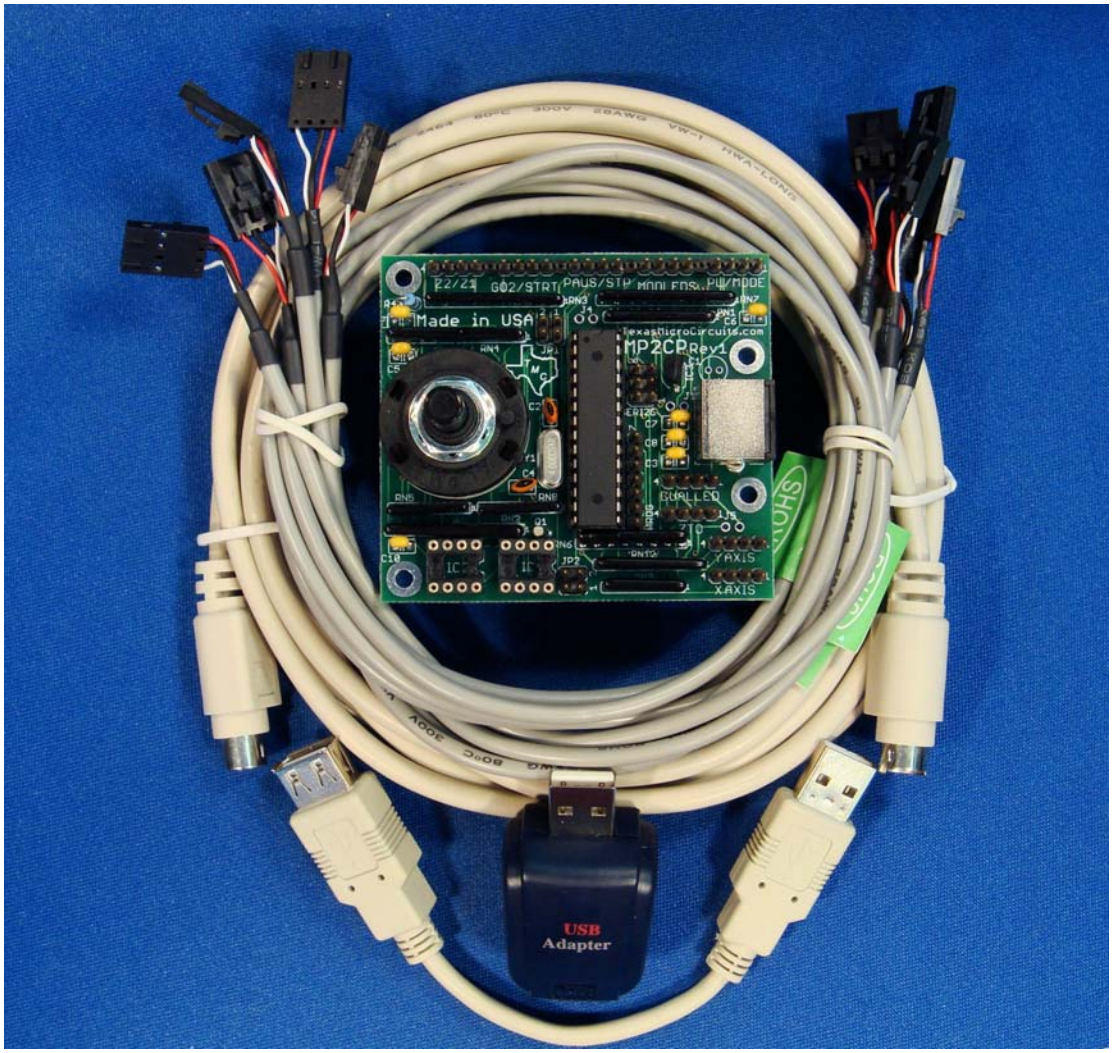

Figure 1 - MiniPendant 2 Control Processor MP2CP DIY kit

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General Description

This MP2CP is kit used to construct a hand-held (or panel) device that remotely controls functions of a CNC machine. It was designed for control of a machine that operates using the Mach 3© software and is programmed to produce "hotkey" commands that Mach 3© uses. It functions as a "keyboard emulator" meaning that it operates as a keyboard equivalent to the system. Any function performed by the pendant is virtually the same as pressing 1 or more keys on the keyboard while running Mach 3©. The Z-axis Touch-Off (ZTO) device is an option to allow the user of the MP2CP to perform a semi-automated tool touch-off. Detailed pendant (and ZTO) functions are explained fully in the **MP2 User Guide**. ***I can't overemphasize the need to refer to the MP2 User Guide for detailed operation.*** This MP2/ZTO User Guide as well as operational videos is located on our website at: www.texasmicrocircuits.com/MP2.htm

Please refer to the MP2 User Guide for all the details of operation. This MP2CP User Guide is more focused on assembly and construction of your own DIY pendant design.

Design Goals

The following were primary goals in developing the MiniPendant 2 Control Processor (MP2CP):

- To functionally operate like a keyboard to the system it is plugged into.
- Connect to the PC via a USB port (with an **active** PS2 keyboard to USB adapter supplied)
- Require no special USB drivers. Works with Windows 2000, XP, and Vista.
- Require no special Mach drivers, macros, brains, or plug-ins (Note: It does require lockdown version **R3.042.020** or later to take advantage of **all** of the functions of the MP2CP. Older Mach versions will support most of the MP2CP functions)
- Support Plug-n-Play and Hot Plugging. The MP2CP can be plugged and unplugged to the PC at anytime and used. No reboot or restarting Mach.
- Uses an "off the shelf" male to male PS2 keyboard cable
- To develop a DIY kit that allows the user to build a pendant for under $100.
- Allow maximum flexibility in user pendant mechanical design.
- In summary, the MP2CP (once built) was designed to just plug in and work.

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What's in the Box

Below are some photos and a brief description of what comes with the TMC MiniPendant 2 Control Processor (MP2CP) basic kit.

MP2CP Printed Circuit Board

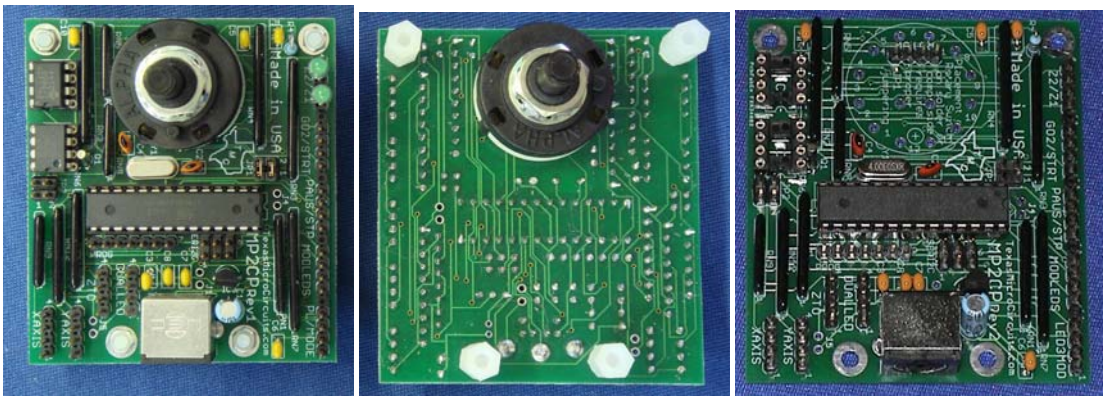

Figure 2 – MP2CP w/Top Mounted Switch, Bottom Mounted Switch or Remote Switch

Keyboard Cable

The keyboard cable is a standard male-to-male 6 pin keyboard cable 10 feet long. Longer cables are available. We support keyboard cable lengths up to 25 feet.

Figure 3 - Keyboard Cable

USB Keyboard Adapter

A PS/2 keyboard to USB adapter is supplied to connect the MP2CP to the PC running Mach.

Figure 4 - USB Keyboard Adapter

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USB Extender

A USB extender cable is supplied with each MP2CP in case the supplied USB adapter "crowds" other USB sockets when plugged directly into the PC.

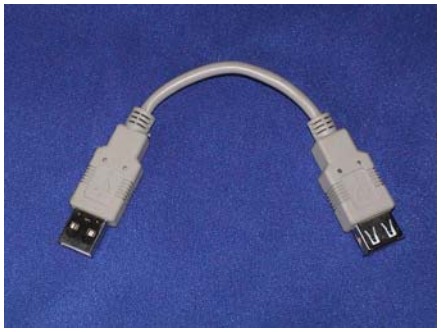

Figure 5 - USB Extender

Shielded Cables for Switches and Joysticks

In the basic MP2CP kit, there are 5 18" long shielded cables. Cut in half, this provides 10 9" cables to be stripped and connected to pushbutton or toggle switches and navigation buttons or joysticks of the user's choosing. These cables have 3 wires (though it is a 4 pin connector). I'll provide more on the pinout later.

Figure 6 - Shielded Cables for Switches & Joysticks

ThumbStick Kit (optional)

The basic MP2CP kit will allow the DIY user to build a pendant using navigation (N, S, E, and W) pushbuttons or his own switch joystick. However, we had many requests for the ThumbStick we use on our MP2 pendant so we made a module and kit with it. We also included the 2 green "mode" LEDs (with an extra green LED for future use) and the dual (red/green) "status" LED on the ThumbStick circuit board. This would allow the DIY user to more closely build a pendant like the MP2. The kit contains all of the standoffs, nuts, and spacers (used to fine tune the distance from the knob to the user panel) necessary to mount the joystick on the user's panel. The LEDs are soldered by the user in the final mounting stage to assure proper distance from the pcb to the panel. Three included shielded cables (along with 2 from the basic MP2CP kit) allow direct (non-solder) connection of the ThumbStick to the MP2CP board.

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Figure 7 - ThumbStick kit

Remote Selector Switch Kit (optional)

To provide even more flexibility, some of our users requested that we provide an option where the rotary selector switch was not mounted on the MP2CP pcb but could be connected with a cable to MP2CP. This allowed them to have more flexibility when designing their custom enclosure to have the rotary switch mounted on a part of the front panel a distance from where the MP2CP was actually mounted. We provided this enhancement with the Remote Selector Switch kit.

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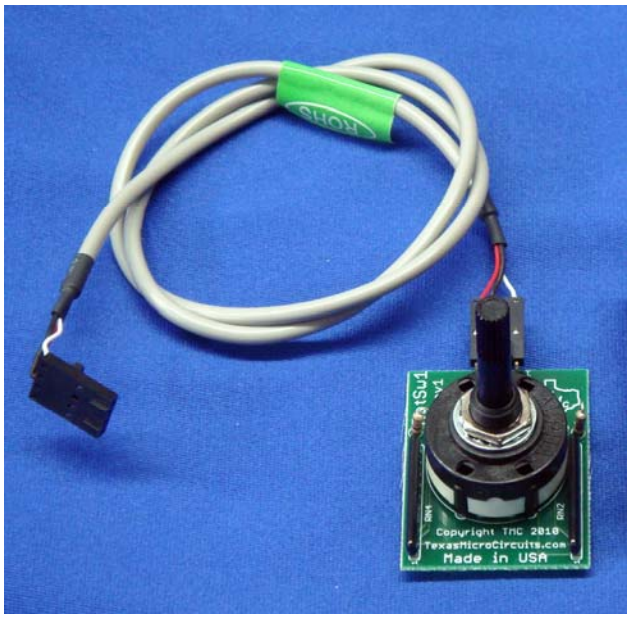

Figure 8 - Remote Selector Switch Kit

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Locations

MP2CP Pendant PCB Connection Locations

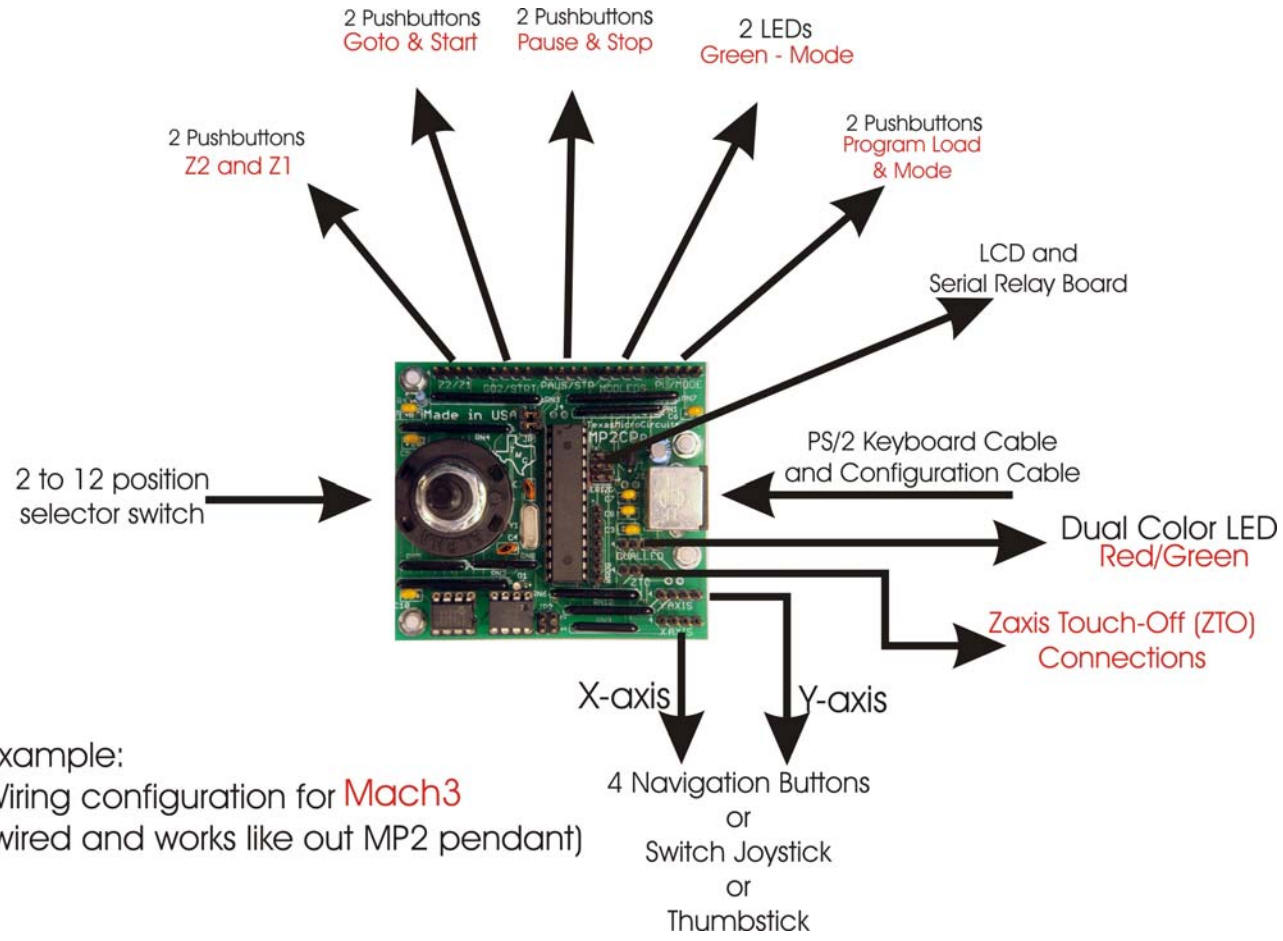

Figure 9 – MP2CP Pendant Connection Locations

Navigation Buttons, Joystick, or ThumbStick

The joystick controls movement of the X/Y/Z/A axes. It also controls the Spindle Speed Override and Feedrate Override. It is designed to be manipulated by the thumb of the user and can be used in either the right or left hand. The joystick features a switch that is activated by depressing the joystick knob. This switch cycles the jogging speed mode.

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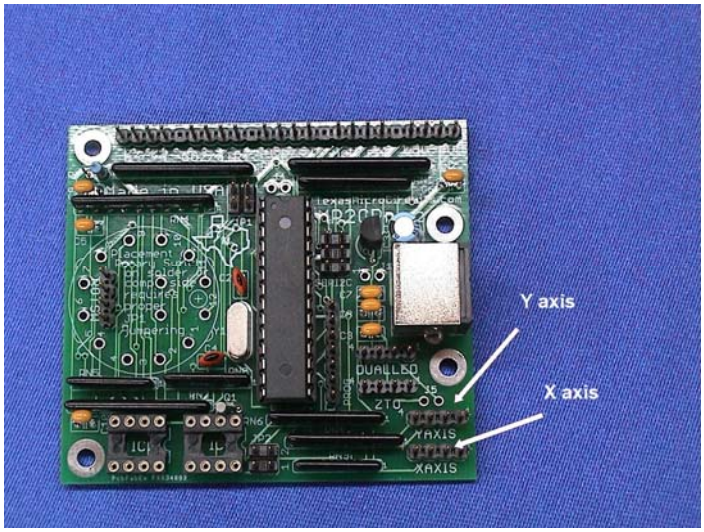

Figure 10 – X and Y Axis Connection Locations

Figure 11 - Navigation Buttons (example configuration)

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Figure 12 - Switch Joystick (example configuration)

The figure below shows an example panel with the ThumbStick assignments for Mach3.
Actually the 3rd LED is a future enhancement to the Mach3 configuration. Only the left 2 LEDs (and the Dual LED showing "Activity" are used just like on our MP2. Our online files show both configurations.
This is an example panel and not included or available. However, the DXF and VCarve file will be posted on our website along with all the other examples of panels so you can make your own. I'll also provide the Avery label file so you can print/laminate your own if you can't engrave one.

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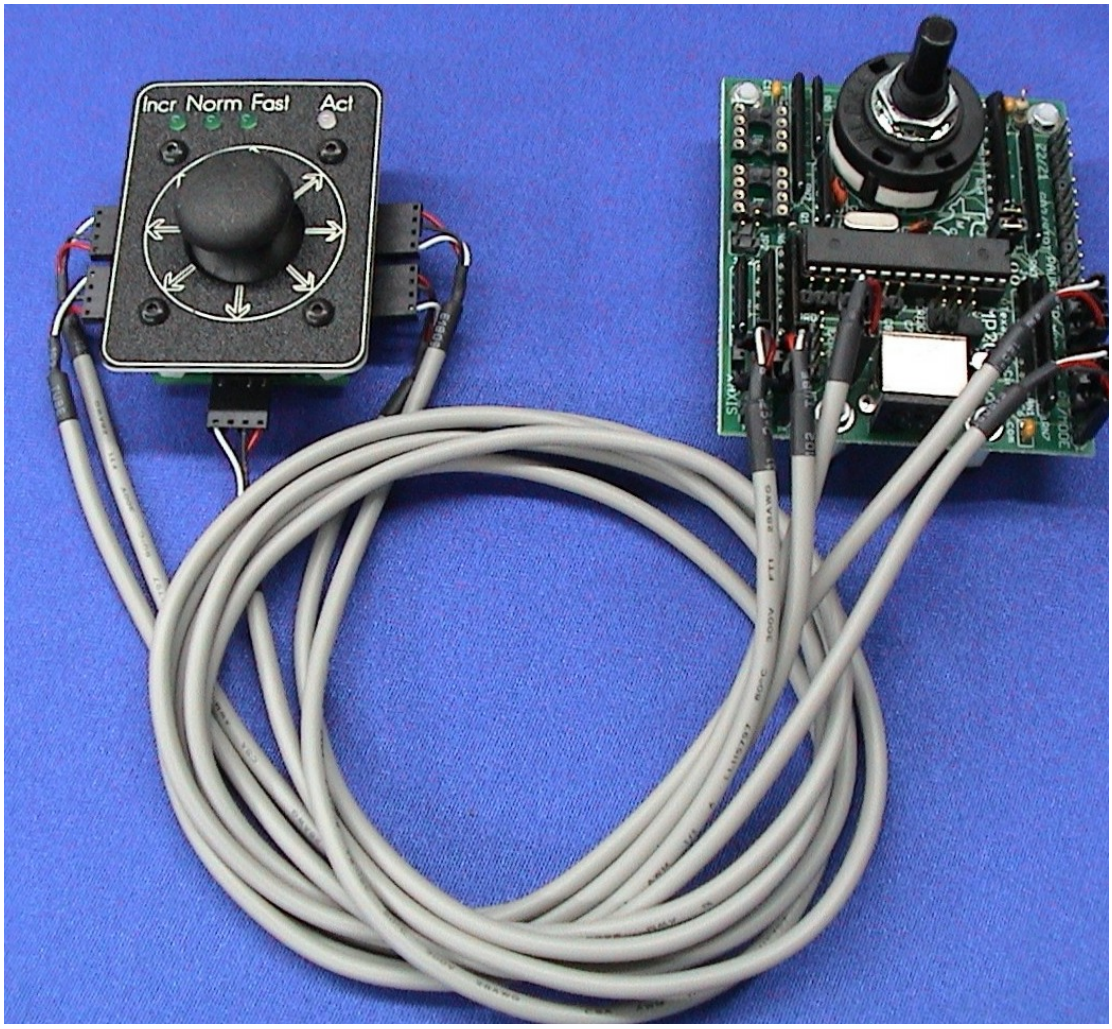

Figure 13 - ThumbStick / LED Connection to MP2CP

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LED Indicators

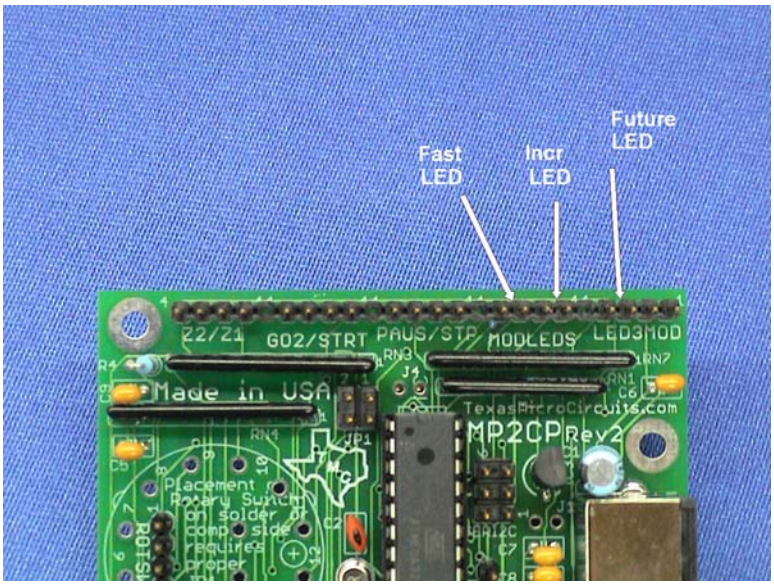

Figure 14 - MP2CP - LED Locations

Pushbuttons

The 6 pushbuttons are divided into 2 groups. The top 3 pushbuttons (Green, Yellow, and Red) are the standard Start (Cycle Start), Pause (Feed Hold), and Stop (not ESTOP) control buttons and operate independent of the position of the Function Selector Switch. The bottom 3 pushbuttons (Black) are a multifunctional set of controls and are defined by the position of the Function Selector Switch.

Figure 15 – Pushbuttons on the MP2 Pendant

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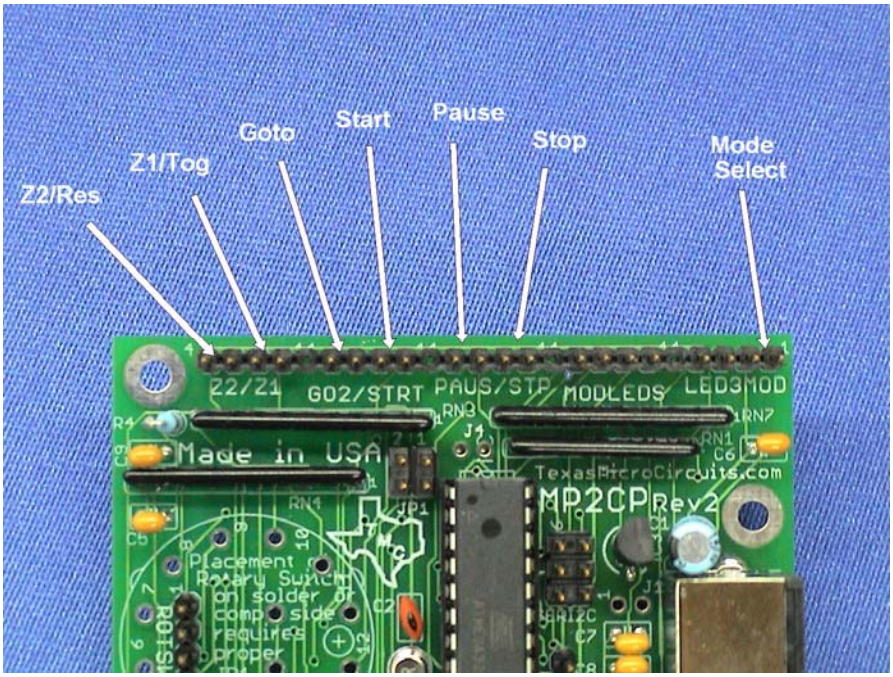

Figure 16 - Pushbutton locations on MP2CP (remote selector switch model shown)

Function Selector switch

The Function Selector Switch is a 10 (up to 12 available) position rotary switch. Each selected position determines the function of the joystick and Black pushbuttons. These functions are explained in detail in the **Operation** section of the MP2 User Guide document.

Figure 17 - Function Selector Switch on MP2

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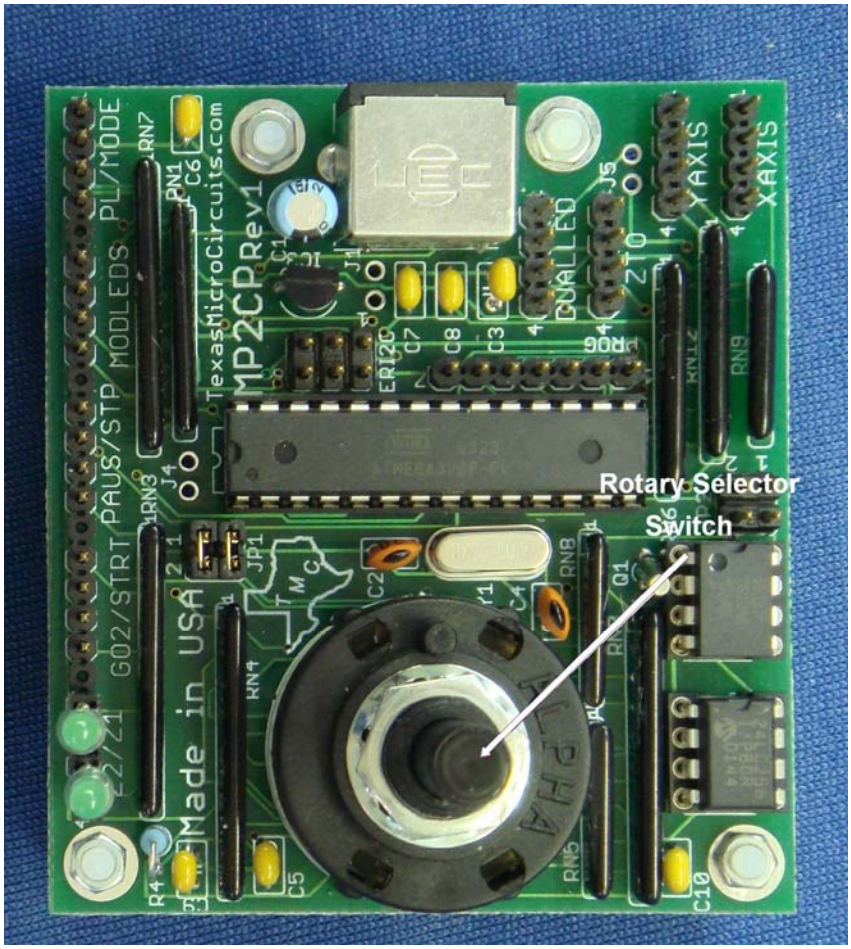

Figure 18 – Function Rotary Selector Switch (Top Mounted)

The figure below shows an example panel with the Selector Switch assignments for Mach3. This is an example panel and not included or available. However, the DXF and VCarve file will be posted on our website along with all the other examples of panels so you can make your own. I'll also provide the Avery label file so you can print/laminate your own if you can't engrave one.

Figure 19 – Function Rotary Switch Example Panel

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ZTO Jack

The ZTO function we provide in our MP2 is also provided in the MP2CP. The 4 pin connector to barrel jack wiring diagram will be provided later in this document.

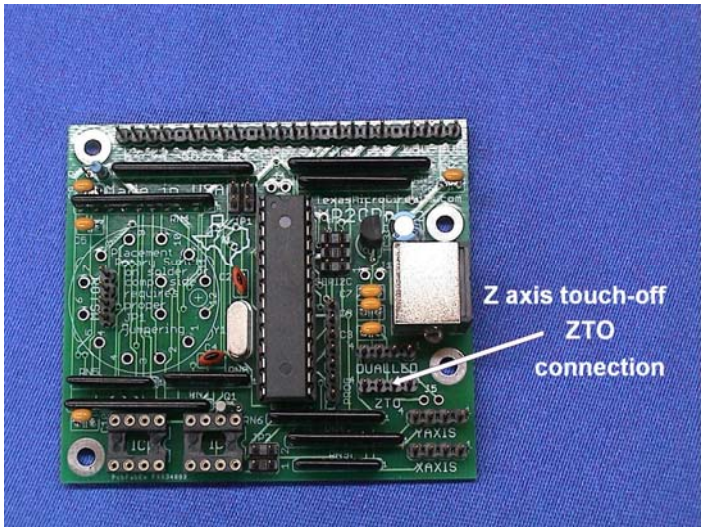

Figure 20 - MP2CP ZTO Connector

Figure 21 - MP2 ZTO Jack

MP2CP Pinouts – The Important Stuff

Since all of the supplied shielded cables come with 4 connector ends, then all the external connections to the MP2CP (and ThumbStick and Remote Selector Switch) also are grouped as 4 conductor pins. Since all of the shielded cables have 3 wires in them (red, black, and white) and all have a 4 pin "shells" or housings, there is one pin that has no wire. We receive our cables from more than one source and we find that some are wired differently than others but it the end it doesn't really matter as long as you pick a pin to call pin #1. If you'll notice in Figure 22 below that the "arrowhead" on the connector shell or housing usually points to Pin #1. However, you can also see that the two different cables show different color wires in "Pin 1" as well as the black wire is in pin 2 in one cable and pin 3 in the other. Not to worry. I treat each pin2 and pin3 as the same and these 2

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pins are jumpered together on the MP2CP, Thumbstick, and Remote Selector Switch boards for each 4 pin connection. So no matter whether the black wire is in pin 2 or pin 3, it is always correct electrically. Now each 4 pin connector on each of the 3 boards (MP2CP, ThumbStick, and Remote Selector Switch) is labeled showing Pin 1 and Pin 4 as shown in Figure 23 for all 4 pin connections. Let's say we pick the red wire as Pin 1 for the sake of all of our discussions here.

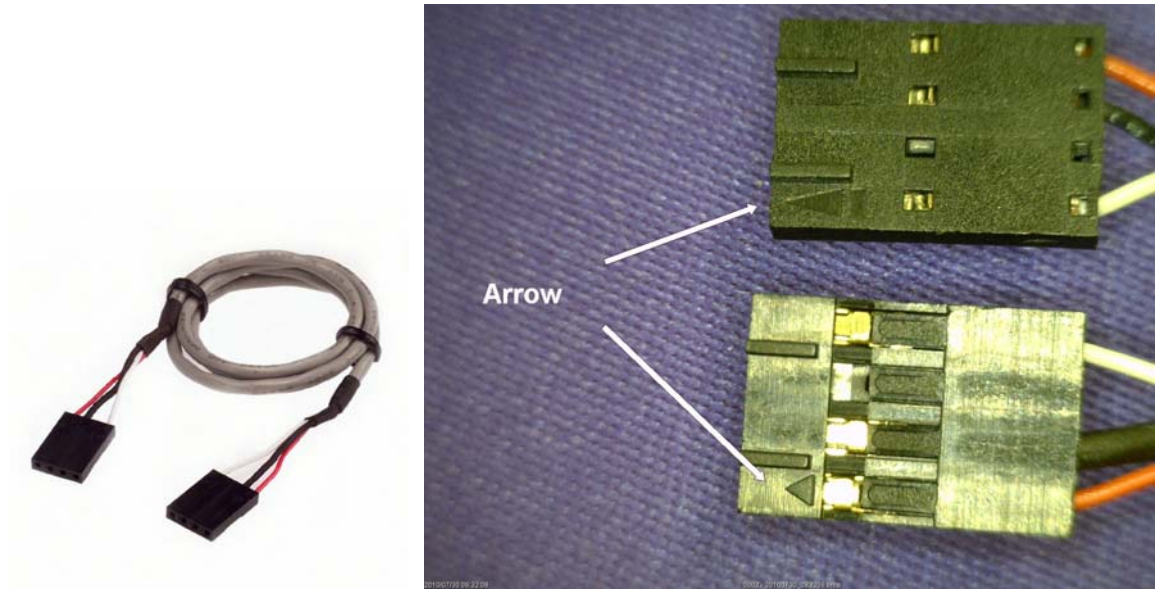
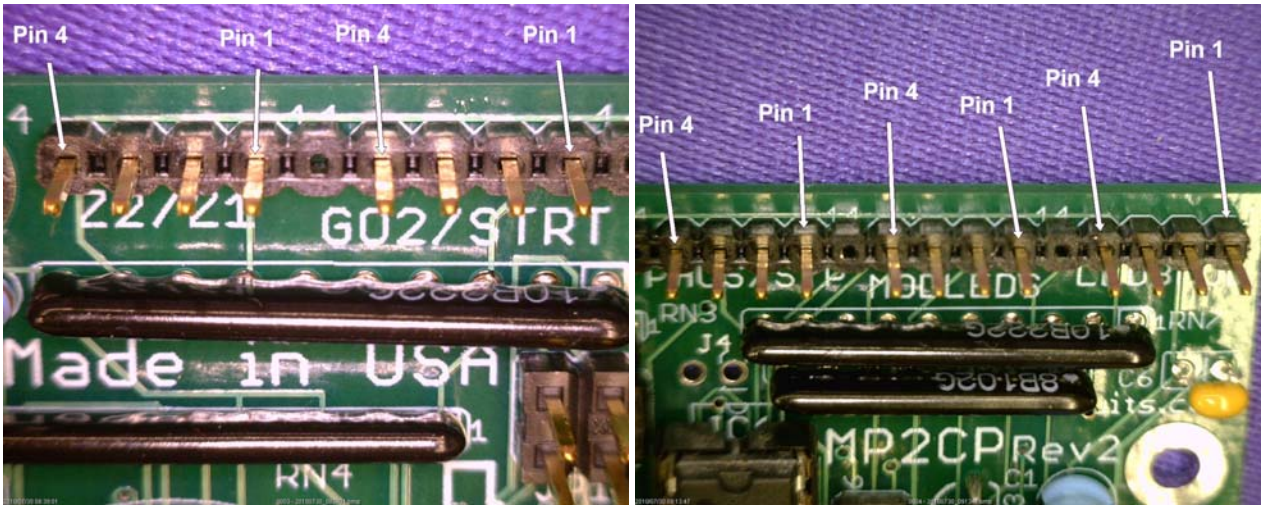


Figure 22 - Shielded Cable Pin Numbering



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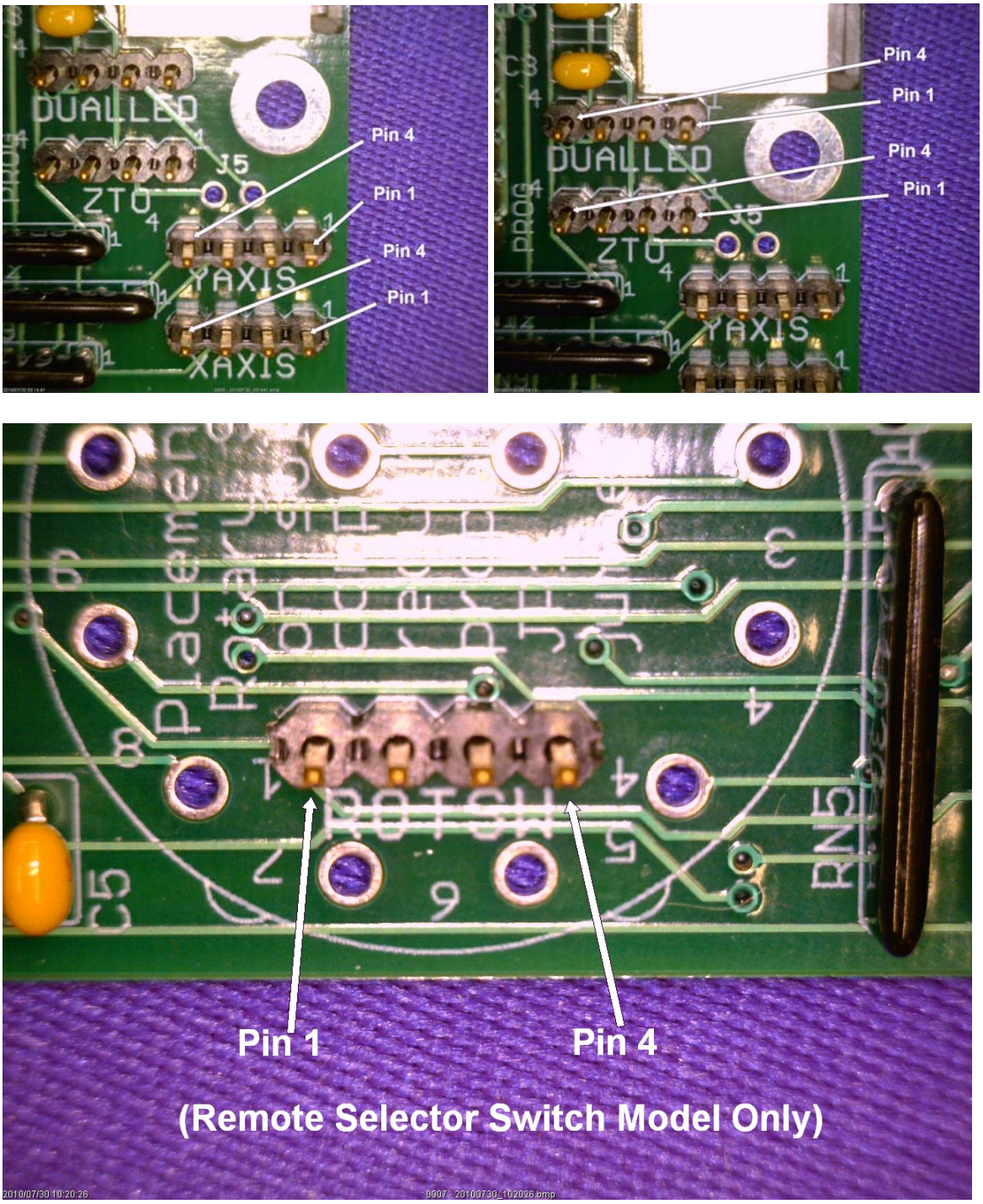

Figure 23 - MP2CP Pin Numbering

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ThumbStick Pinouts

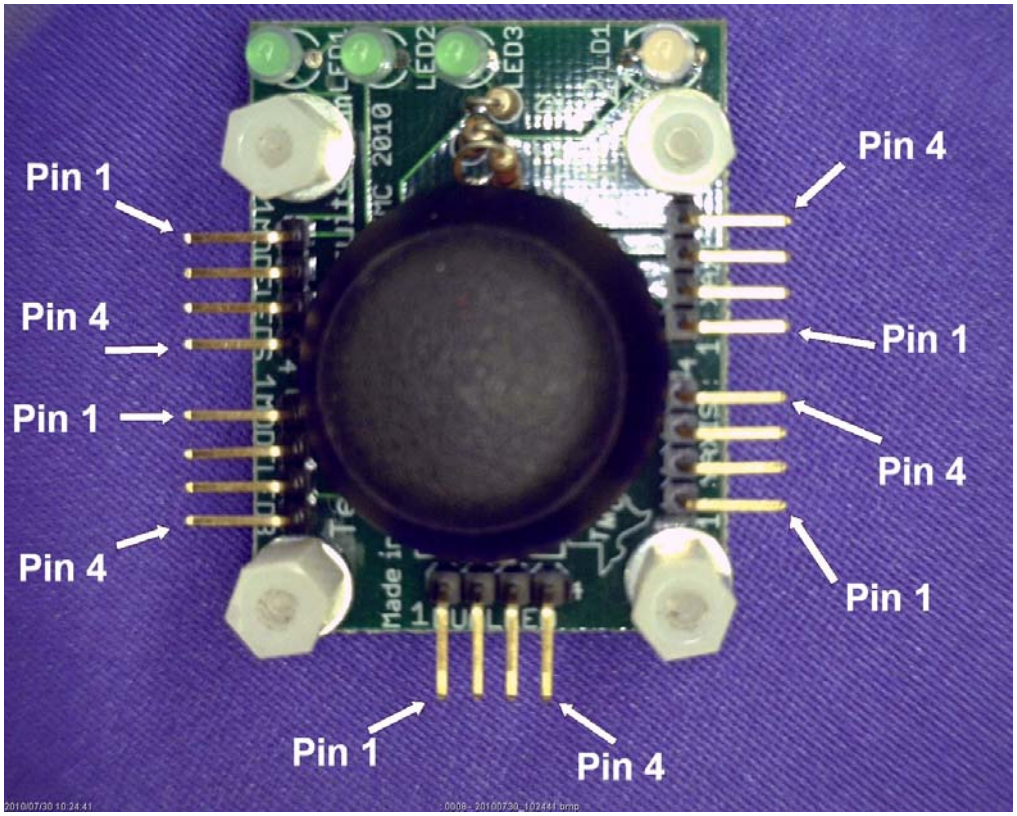

Figure 24 - ThumbStick Pin Numbering

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Remote Selector Switch Pinouts

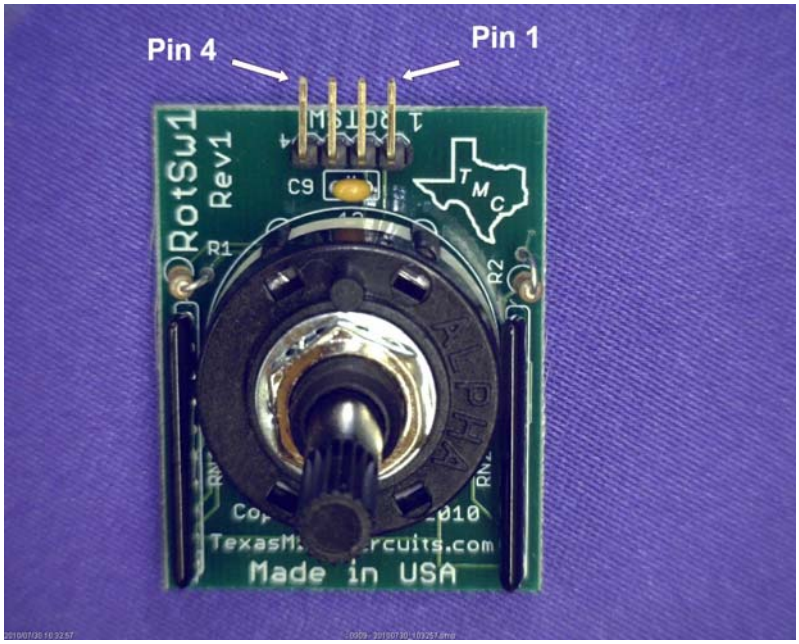

Figure 25 - Remote Selector Switch Pin Numbering

Construction Tips – Getting Down to Enclosing and Wiring the Pendant

Tidbits – Good to Know Things When Building Your Pendant

Stripping the Shielded Cables

The shielded cables we use for the switch and LED connections on the MP2CP were chosen for a variety of reasons:

- They were relatively inexpensive “off the shelf” product which save the DIY user the trouble of soldering little pins on the end of wires to connect to the 4 pin headers. The cables are the CD audio cable used to connect a CD player in a PC to the motherboard.
- They are shielded. Since we use analog (more explanation on the “why” of this in a later detailed design section (to be written)
- They use small enough wire that we can get a good many of them into a small enclosure, yet not too small as to make it difficult to strip and tin.
- They are easy to obtain (even though we sell them) from many sources that sell PC cables

I find that I use 2 tools to strip and prepare the wires when connecting the pushbutton switches. I use an “Xacto” knife using a pointed blade but you can use any variation including a safety razor blade. Just be careful as this is a very sharp too. This is a common tool that you can get many places:

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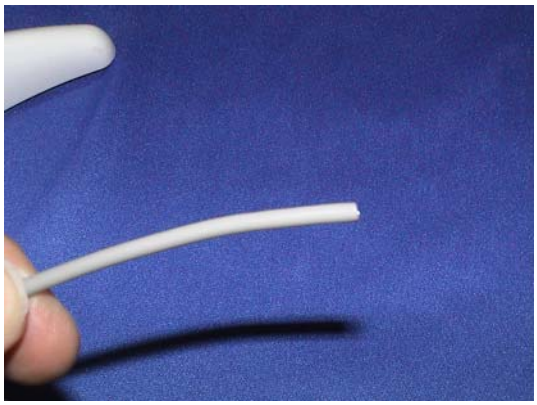
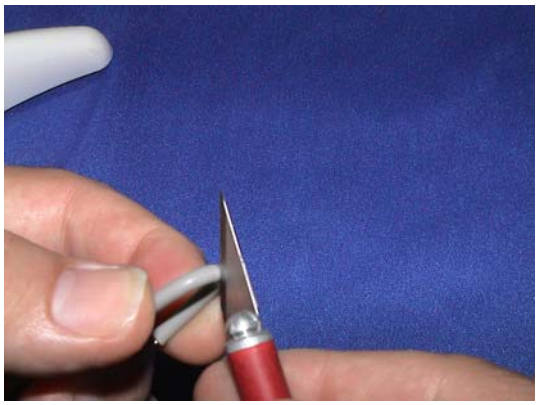
Figure 26 - Xacto kife and blade

Xacto Knife Sources

Source	P/N	Online link	Price (7/10)	Notes
Office Depot	930255	Officedepot.com	$6.09	Extra blades avail.
Amazon	X3202	Amazon.com	$3.00	
Office Max	11013217	OfficeMax.com	$4.79	
Micro-Mark	14349	MicroMark.com	$2.65	

use this knife to cut the outside jacket of the cable only. For stripping the wires I use a wire stripper. Here is how I use the Xacto knife to cut the outside jacket.
First I take the shielded cable and cut it to the length I need. Then I bend the wire the distance from the end that I want the wires to be in length. By bending the wire over, this puts tension on the jacket and it splits easily before you cut into the wires. Then I "roll" the knife edge around the jacket firmly enough to cut the jacket but softly not to cut the wires inside. See photos below:

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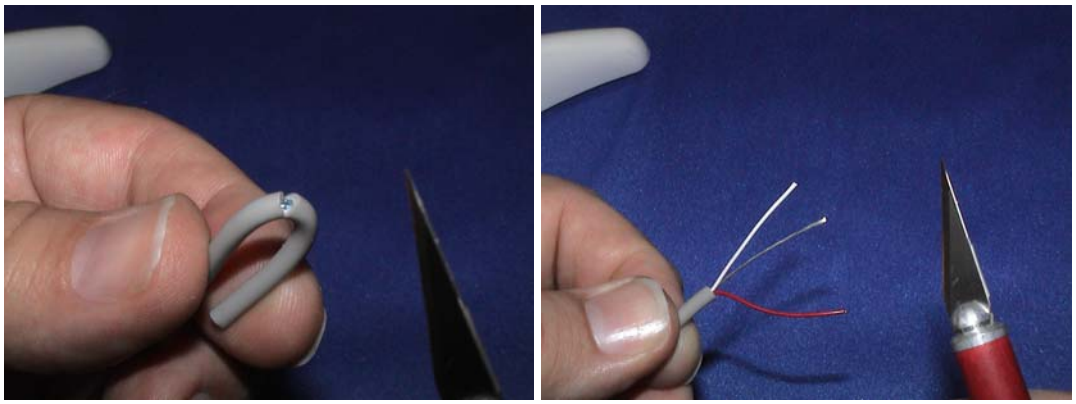

Figure 27 - Cutting the Jacket on the Shielded Cable

Next I use the stripper of choice (and I have several) to strip the individual wires. There are many kinds of strippers and it depends on your budget. Here are some examples and sources:

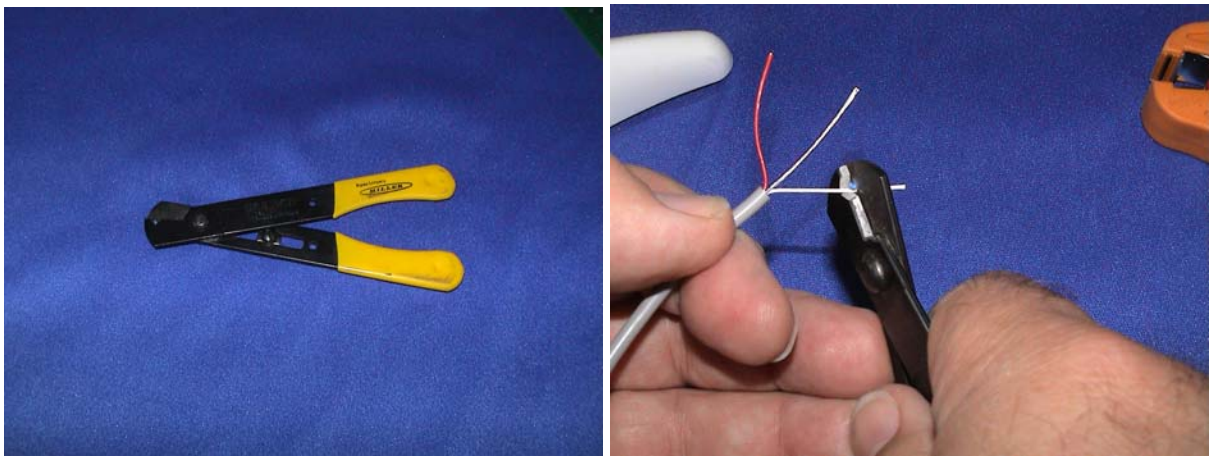

Figure 28 - Least Expensive Strippers

Inexpensive Wire Strippers (product may look a bit different)

Source	P/N	Online link	Price (7/10)	Notes
Amazon	B0002KRAC4	Amazon.com	$2.98	Others available
Radio Shack	64-074	Radioshack.com	$5.99	Others available

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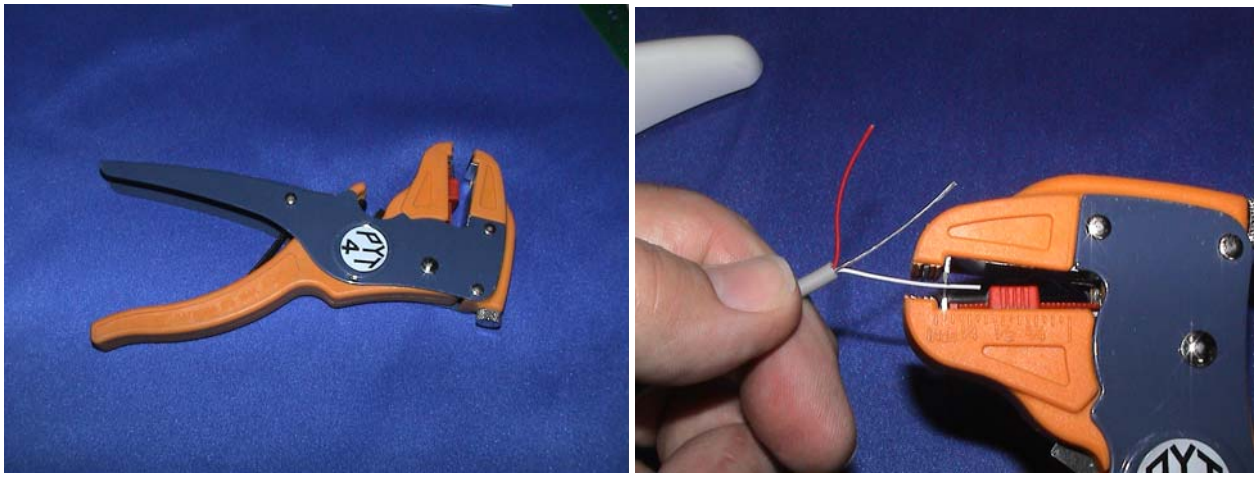

Figure 29 – Medium Cost Strippers

Medium Cost Strippers

Source	P/N	Online link	Price (7/10)	Notes
Amazon	B0002KR95W	Amazon.com	$17.05	Others available
Frys	1563227	Frys.com	$9.99	

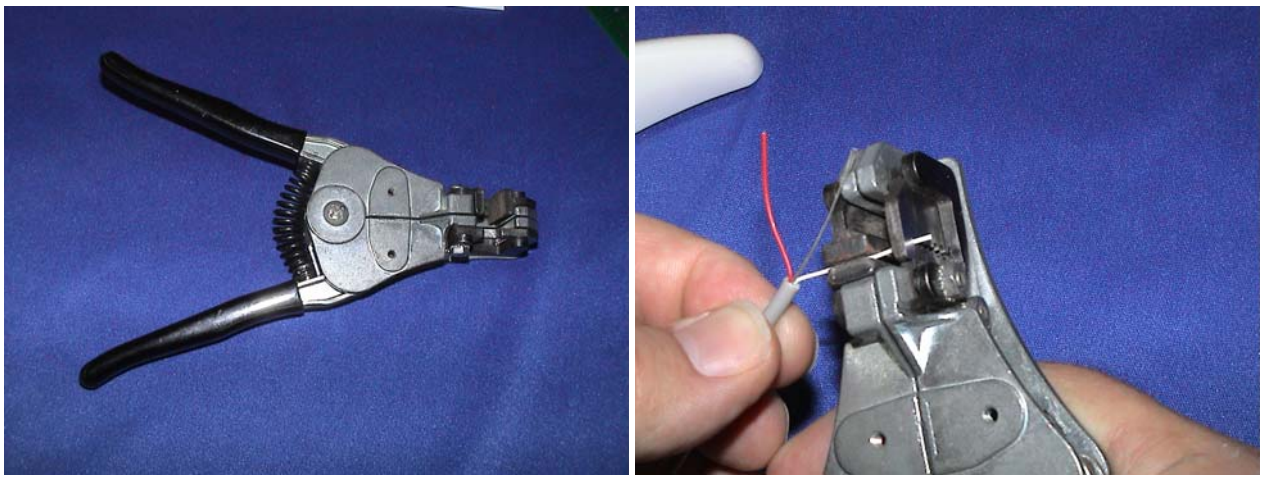

Figure 30 – Higher Cost Strippers

Higher Cost Strippers

Source	P/N	Online link	Price (7/10)	Notes
Amazon	B001HW925Y	Amazon.com	$34.49	Others available
Lowes	34029	Lowes.com	$24.95	
Micro-Mark	81317	MicroMark.com	$14.95	Look different

Connecting Pushbutton Switches and Detailed Pinout Listing

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As stated above, all of the connectors are 4 pins on the MP2CP, ThumbStick, and Remote Selector Switch. Pins 2 and 3 are connected on each of the pcbs on all 4 pin groups. This means you don't have to worry whether the shielded cable you get has a wire missing in pin 2 or pin 3 as long as there is a wire in one of them.

Now the basic switch or LED connection to each of the 4 pin groups is consistent. Pin1 1 connects to Pin 2 to make a switch or LED connection. Pin 3 connects to Pin 4 to make a switch or LED connection. **All switches are normally open (N/O).**

When a pin is labeled "Common for Pin 1&4" below, it means that you can connect Pin 1 or Pin4 to that "Common" pin **for that group** to complete the switch or LED connection.

For example, if we are going to wire up the "Start" pushbutton, we would cut and strip a shielded cable and connect the wires that go to Pin 1 and Pin 2or3 to that normally open pushbutton switch to complete the wiring of the "Start" button. I'll show this in some photos below. Now, of course, since there are only 3 wires in the cable, the "Common" wire (black one, which is really a bare stranded wire with a black piece of shrink tubing over it) will need to be shared with the other switch in the 4 pin group. For example, in the earlier example we connected Pin 1 (lets choose the red wire as pin 1) to pin 2/3. This means we connected the red wire and the black wire to the "Start" switch. If we also wanted to connect up the "Goto" pushbutton (N/O) switch, we would connect up the white wire and the black wire (same one we connected to the Start switch) to make this switch active. Therefore we share the black wire in this group. Where switches are mounted close, this sharing of the black wire is pretty easy as you just trip a longer piece of insulation off and "daisy chain" the black wire from one switch to the other. If the switches in your particular design are farther apart, you may need to run a the red a black wire to the "Start" switch and a short "pigtail" wire from the black wire connection on the "Start" switch to the "Goto" switch as well as running the white wire to the "Goto" switch. I'll show this better in a couple of photos.

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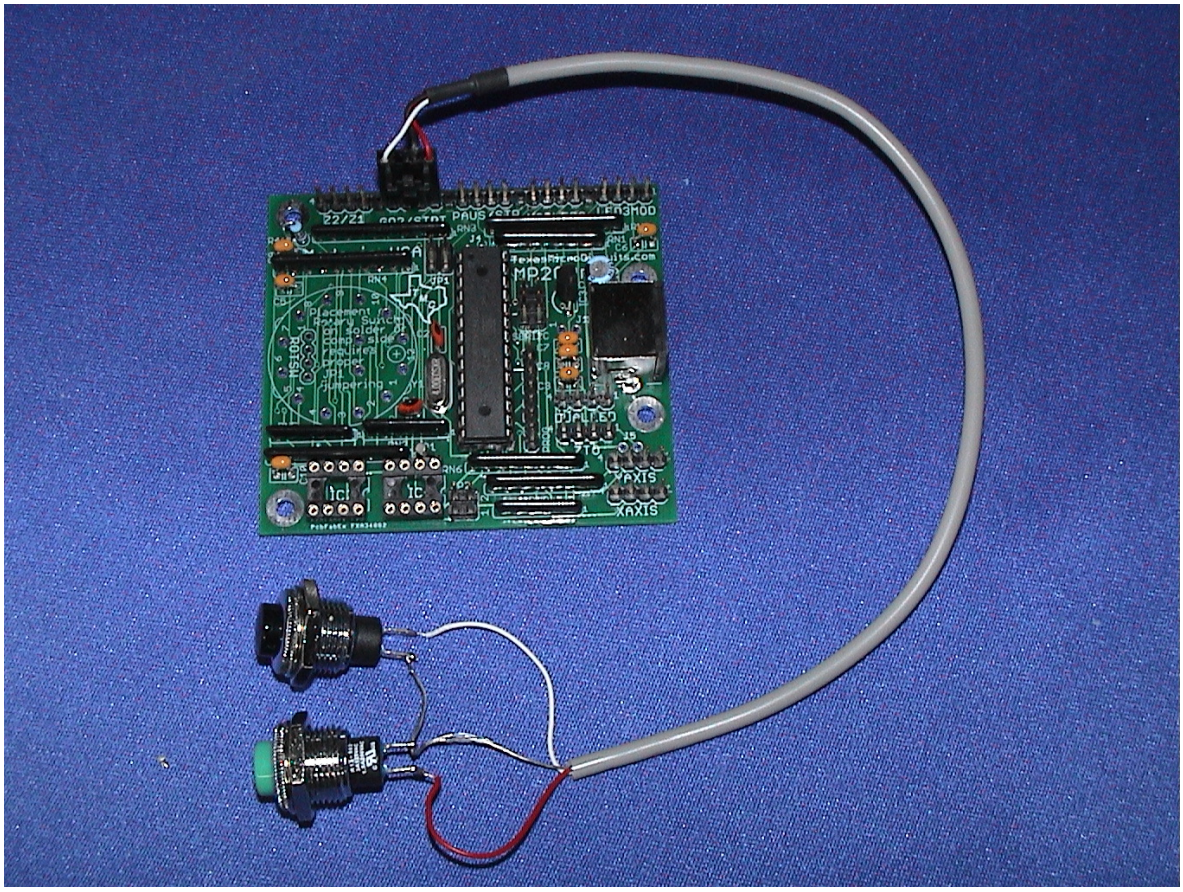

Figure 31 - Switches That Are Physically Close to Each Other

Notice that I put a piece of sleeving or heat-shrink tubing over the bare “Common” wire to keep it from touching other connections. I use heat shrink tubing and it has become very cheap. Sources for heat shrink tubing to follow photo below. I added a piece of black wire to extend the “Common” wire to the other switch.

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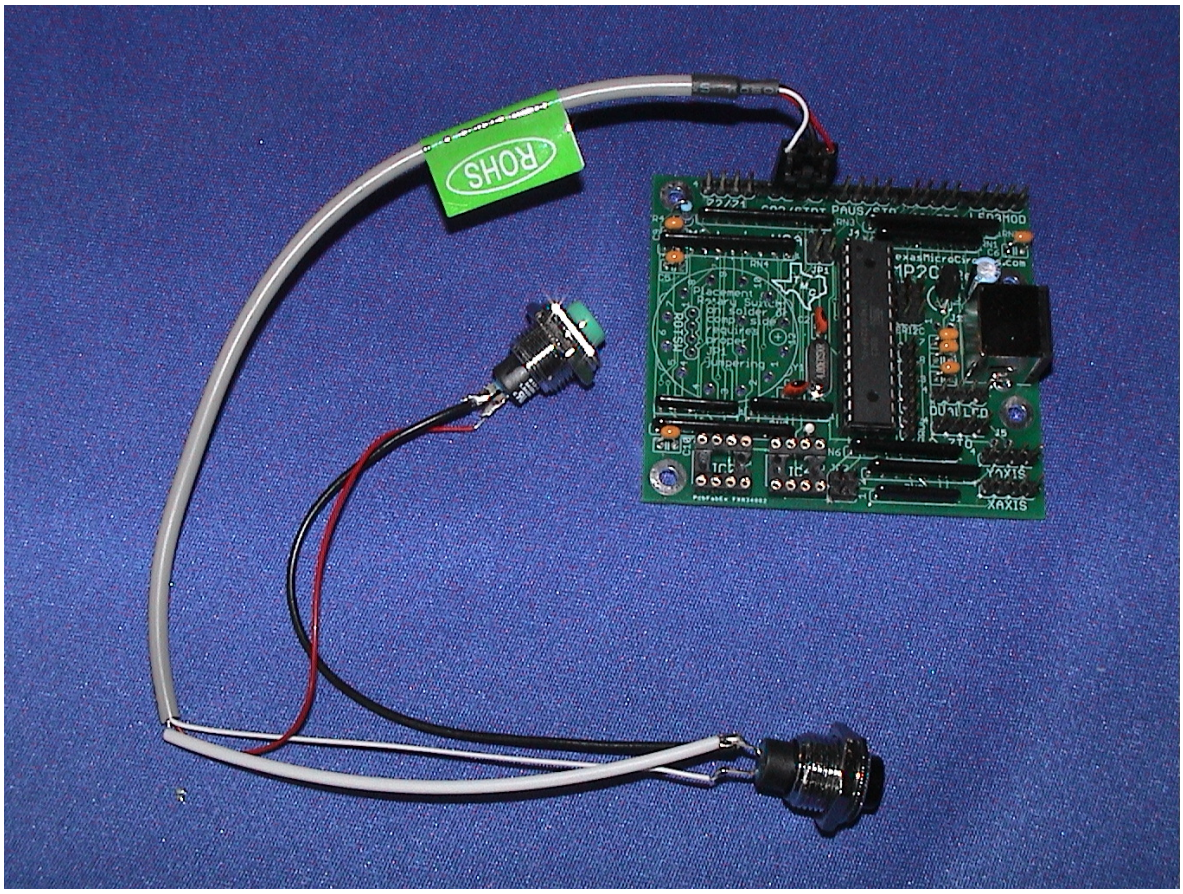

Figure 32 - Switches That Are Physically Farther Apart

Sources for Heat Shrink Tubing

Source	P/N	Online link	Price (7/10)	Notes
Amazon	B00262KJJ2	Amazon.com	$0.76	48” long 1/16” id
Mouser	5174-11167	Mouser.com	$0.92	48” long 1/16” id
Radio Shack	278-1610	Radioshack.com	$3.99	12 pack various
Mouser	5174-33161	Mouser.com	$1.76	3/16”id 48” very flexible

If, for some reason, the DIY user wants to make up their own cable connections instead of using the supplied shielded cables, here are some sources for the pins and shells to solder your own wires to. It will take some patience and skill unless you have one of the expensive crimpers.

Sources for Pins and Shells for 4 Pin Headers

Source	P/N	Online link	Price (7/10)	Notes
Mouser	538-50-57-900	Mouser.com	$.86 each	4 pin shell
Mouser	538-16-02-0102	Mouser.com	$0.07 each	1 pin (crimp)

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Digikey	WM2802-ND	Digikey.com	$0.89 each	4 pin shell
Digikey	WM2510-ND	Digikey.com	$0.226 each	1 pin (crimp)

LED Sources

Source	P/N	Online link	Price (7/10)	Notes
3mm Green LED	638-MV5474C	Mouser.com	$0.22	each
3mm Dual LED	604-WP3VEGW	Mouser.com	$0.27	Red/Green
5mm Green LED	604-WP7113GD	Mouser.com	$0.09	each
5mm Dual LED	638-MV5437	Mouser.com	$0.35	Red/Green

Shortening Cables – Cut and Splice

The cables shipped with the MP2CP kits are 18” long. This length was the most cost effective ones available at the time and plenty of length for the DIY user to wire up his pendant and have the most flexibility. However, there are times (more often than not) that the cables are too long and they need to be shortened. Assuming that the cables that need to be shortened are the ones that need to retain the 4 pin connectors on each end, there are 2 ways to shorten the cables and still have them be flexible. We’ll go through the first procedure (along with several photos) to show how a cable can be cut and spliced to practically any length that the user needs.

So basically cut the cable to the length you need. Strip the wires ¾” and tin them like you did above when connecting the cable to the pushbuttons.

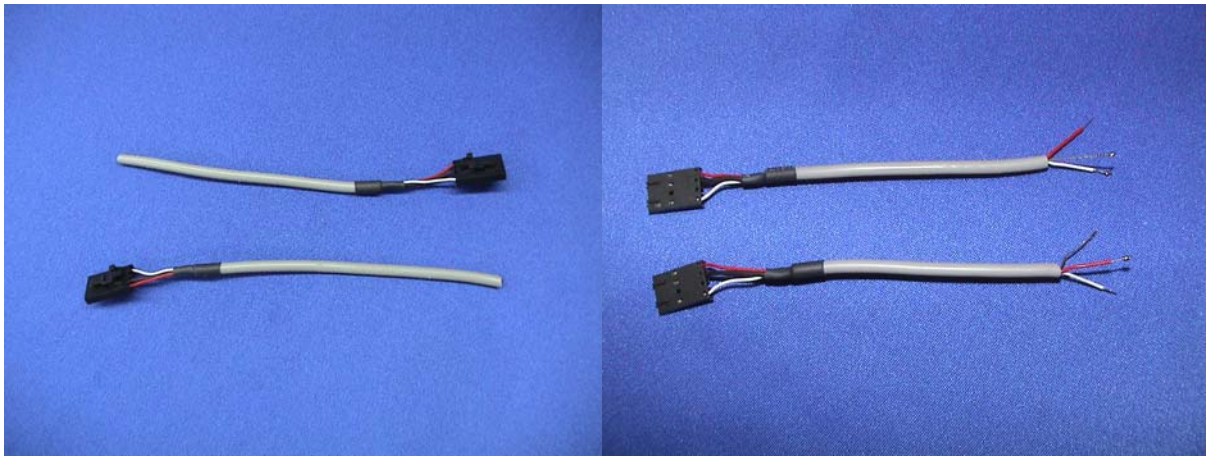

Figure 33 - Cut and Strip Wires

Next, cut a 2” piece of 3/16” id heat shrink tubing about 2” long. One of the tables above shows the P/N of a very flexible heat shrink tubing we use from Mouser. This tubing is shipped in our Enhanced Mounting Hardware Option. Be sure to place it on one of the cable ends before you start soldering the wires….or you’ll be unsoldering them to install it. I know…I’ve been there. Next take a small piece of 1/8”id heat shrink tubing and cut it to about ½” and place it over one of the colored wires. You want it to be just long enough to cover the soldered wires but short enough so that it is far

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enough away from the hot wire you just soldered that it doesn't start to shrink before you've moved it into place.

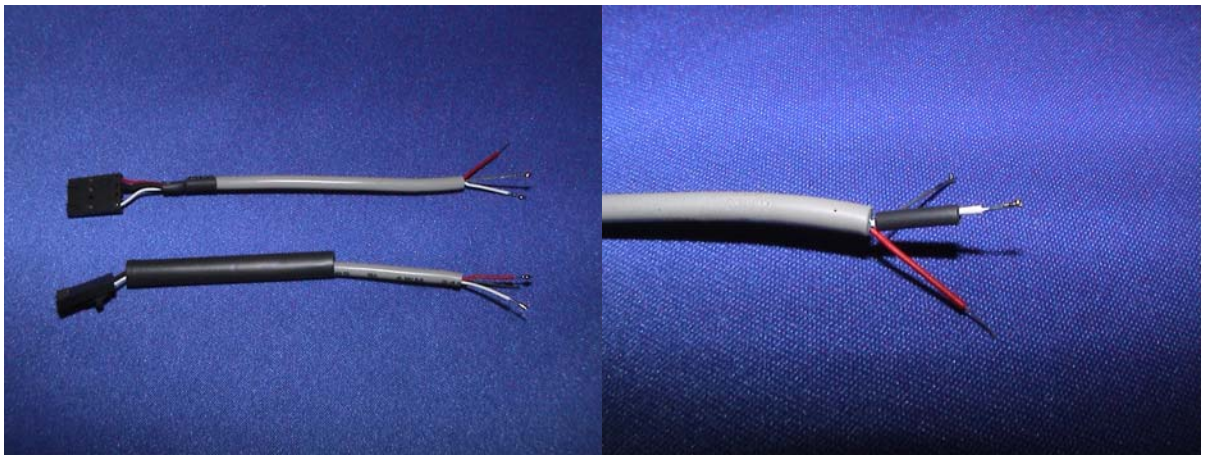

Figure 34 - Heat Shrink Installation

I have used something called "Helping Hands" for 30+ years to hold items to be soldered and Radio Shack still sells these. There is a table below on sources. This is the easiest way I know when you need 3 or 4 hands to hold all the things when you need to solder small parts/wires. I would suggest investing in one or something like it. You can also make a simple one out of a couple of alligator clips and some stiff wire (see Instructables in table below.)

Now you want to position your cable ends in a "helping hands" or equivalent and "touch" solder the ends. Touch solder means to place the 2 pre-tinned wires parallel and touching each other and quickly touch a hot soldering iron to them to melt the existing solder. Don't use too much heat as it will heat up the wire and may start shrinking the tiny tubing before you have had a chance to move it into place. This provides a good connection in spite of the old electronics adage about making a solid mechanical connection before soldering.

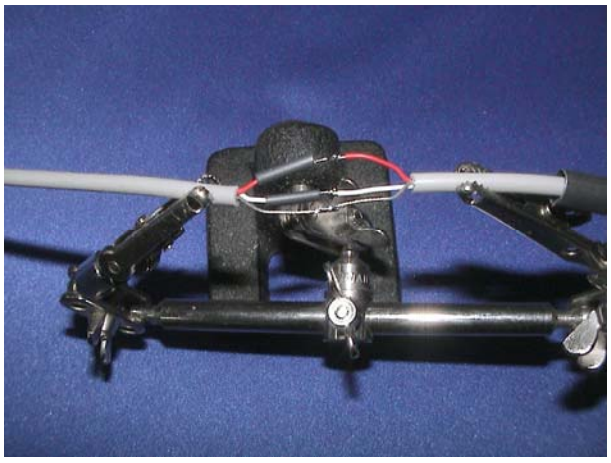

Figure 35 - "Touch" Solder Wires

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Helping Hands – Alligator clip stand to help hold small pieces to be soldered

Source	P/N	Online Link	Price 9/3	Notes
Helping Hands	64-079	Radioshack.com	$15.99	w/magnifier
Helping Hands	900-037	Walmart.com	$8.99	w/magnifier
Third-Hand	N/A	Instructables.com	Varies	Search “third-hand”

Last, you want to use a heat gun to shrink the tubing over the soldered wires then the larger tubing over the entire cable. Below is a table that shows sources for heat guns. You can also use a high heat (1400 watts or more) hair dryer to do the trick. What I have found does NOT work well on small wires is to use any flame such as a lighter or match or to use the soldering iron to shrink the tubing. Another heat source is an ordinary paint peeler heat gun.

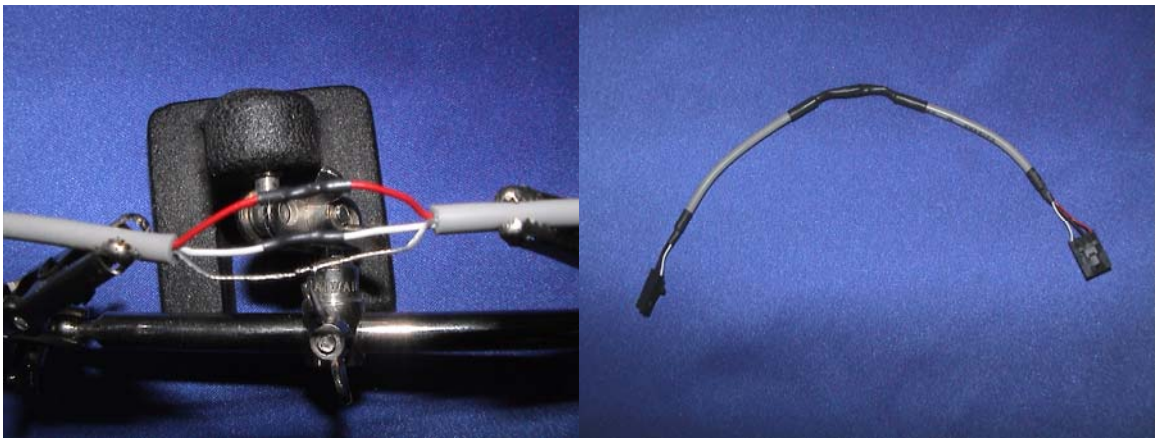

Figure 36 - Shrunk Tubing

Heat Guns

Source	P/N	Online Link	Price 9/3	Notes
Grizzly Heat Gun	H0801	Grizzly.com	$19.95	1200 watt
Black & Decker	9756	Amazon.com	$31.77	10 amp
Wagner Heat Gun	HT1000	Amazon.com	$23.83	1200 watt
Chicago Electric	96289	HarborFreight.com	$7.99	1500 watt

Shortening Cables – Cut and Replace Pins

The other way to shorten cables is to remove the pins from the shell on one end of the cable, cut the cable to the required length, strip the wires, and install new pins. In my opinion, this is a little easier than the cutting and splicing technique, but it requires you to have the pins on hand. Though it can be done, saving the old pins and reusing them is a possibility yet is harder to do. If you know you are going to want to use this method to shorten your cable when you order an MP2CP kit, I can supply the pins. I have also source listed them in a table a few pages back in this manual.

So here is the cable end with 4 pin connector and the single pin. Both are showing the “Stop Tang” that is used to keep the pin in the connector shell.

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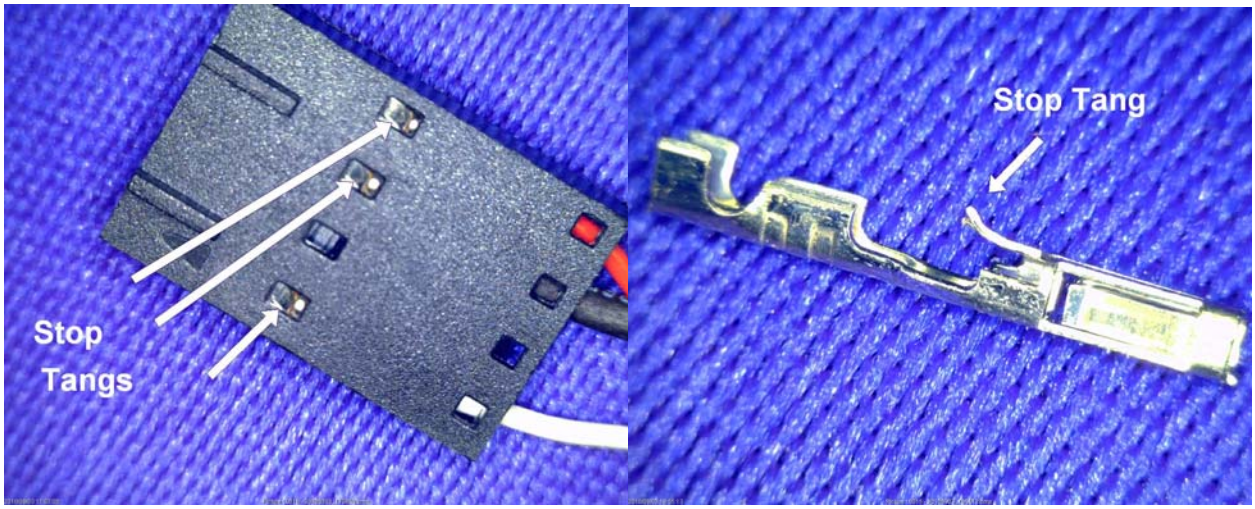

Figure 37 - Stop Tang

Now take your Xacto knife or very pointed object such as a safety pin and press on the tang and bend it down a tad. Then pull the pin from the shell.

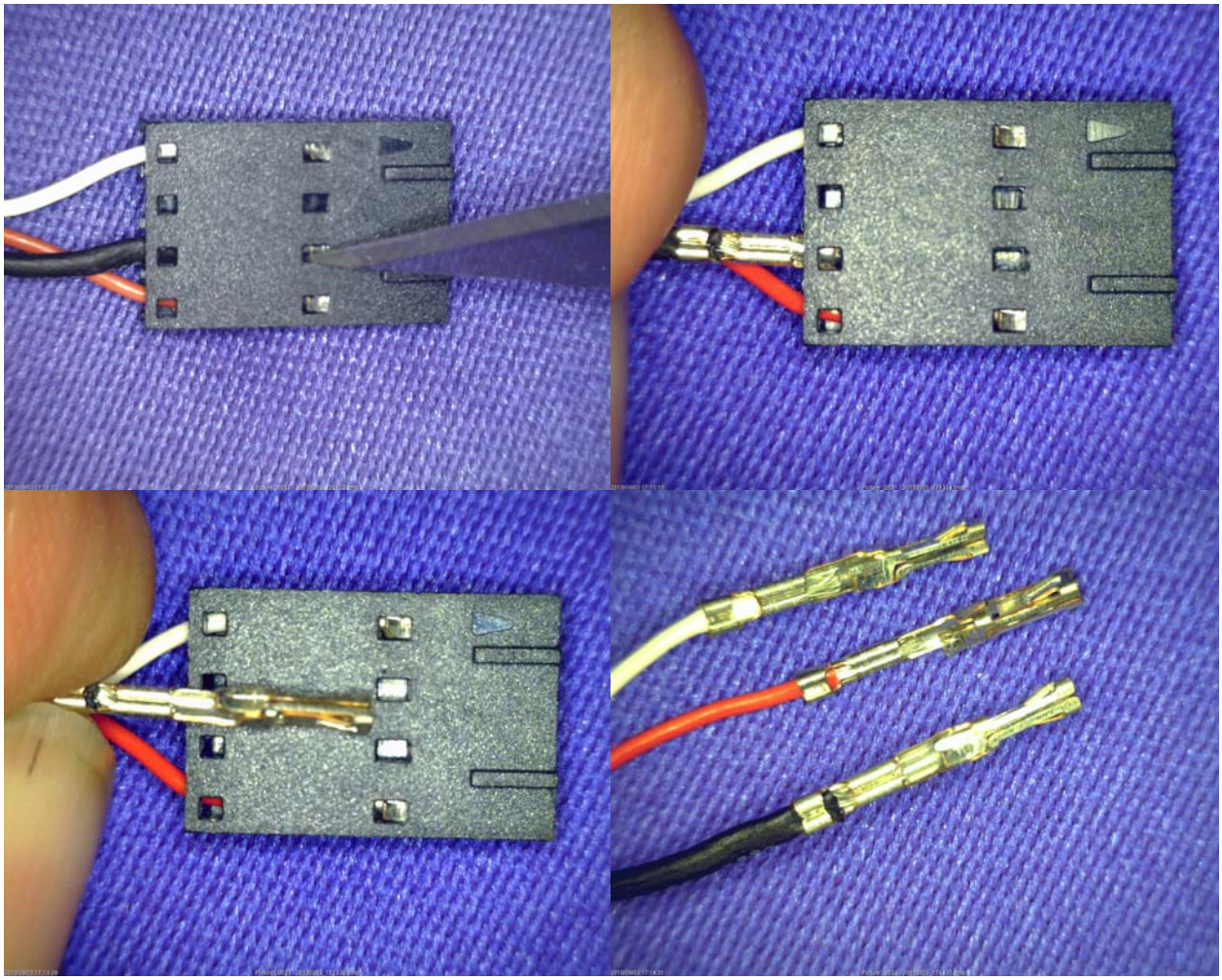

Figure 38 - Removing Pins from Shell

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Now cut the cable to the correct length, strip back about 1” of the jacket and then strip about 1/8” on each of the 2 wires. If you plan to do a lot of this crimping, you can use a commercial crimping tool for these pins…but they’re pricey.

Source	P/N	Online link	Price (7/10)	Notes
Crimp Tool	538-63811-1000	Mouser.com	$49.00	Universal tool

Or you can use a pair of needle nose pliers. I’ve done this for years. It’s a little delicate and you need some nimble fingers but it is much cheaper than the $50 tool above. I always add a tiny bit of solder after I crimp with the needle nose pliers to make a good connection, just don’t let the solder run up into the barrel of the pin or you won’t be able to plug in n the header.

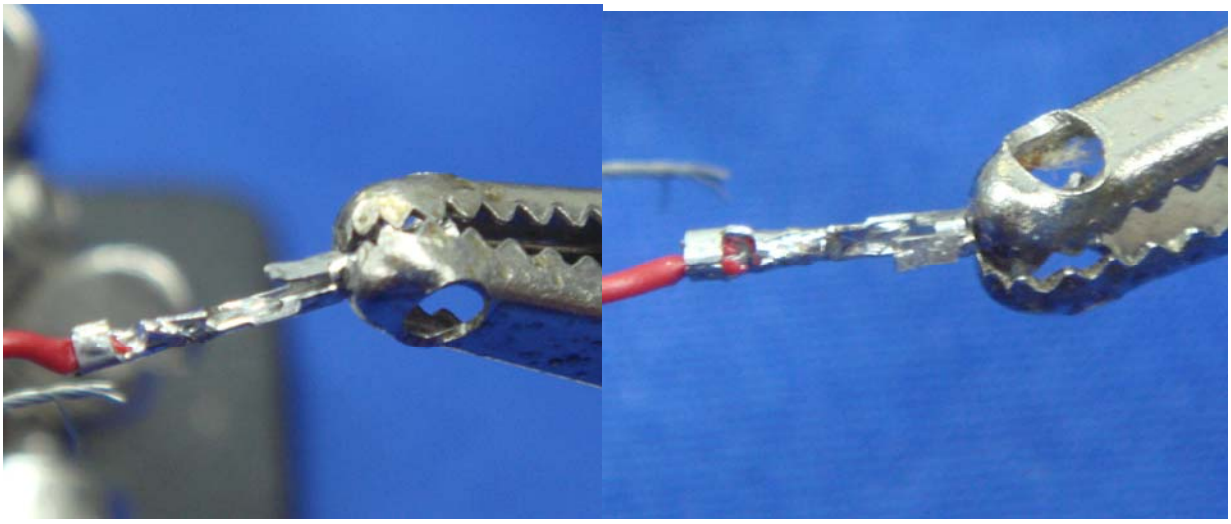

Figure 39 - Crimped and Soldered

Last, insert the pins back in the shell. Be sure to insert them in the correct position and make sure the Stop Tang is oriented to the side with the little square window. You may need to use a sharp object (Xacto knife or safety pin) to push the pin the final bit of travel until you hear the Stop Tang “click” into place. Then tug a little on the wire to make sure it is locked. The center wire can be inserted into either hole 2 or 3 because they are both connected together on each 4 pin header on the pcb.

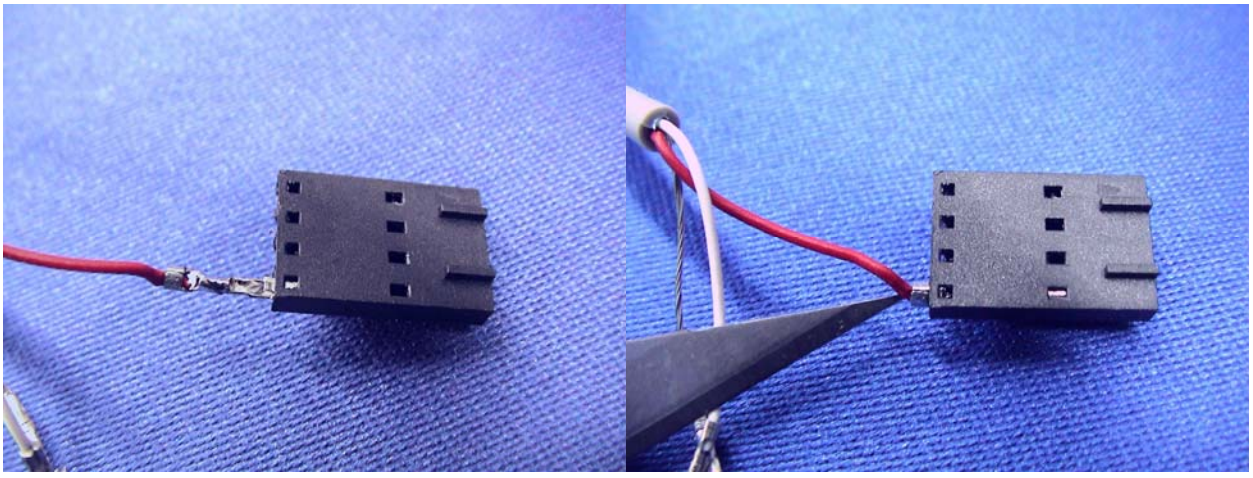

Figure 40 - Inserting the Pins in the Shell

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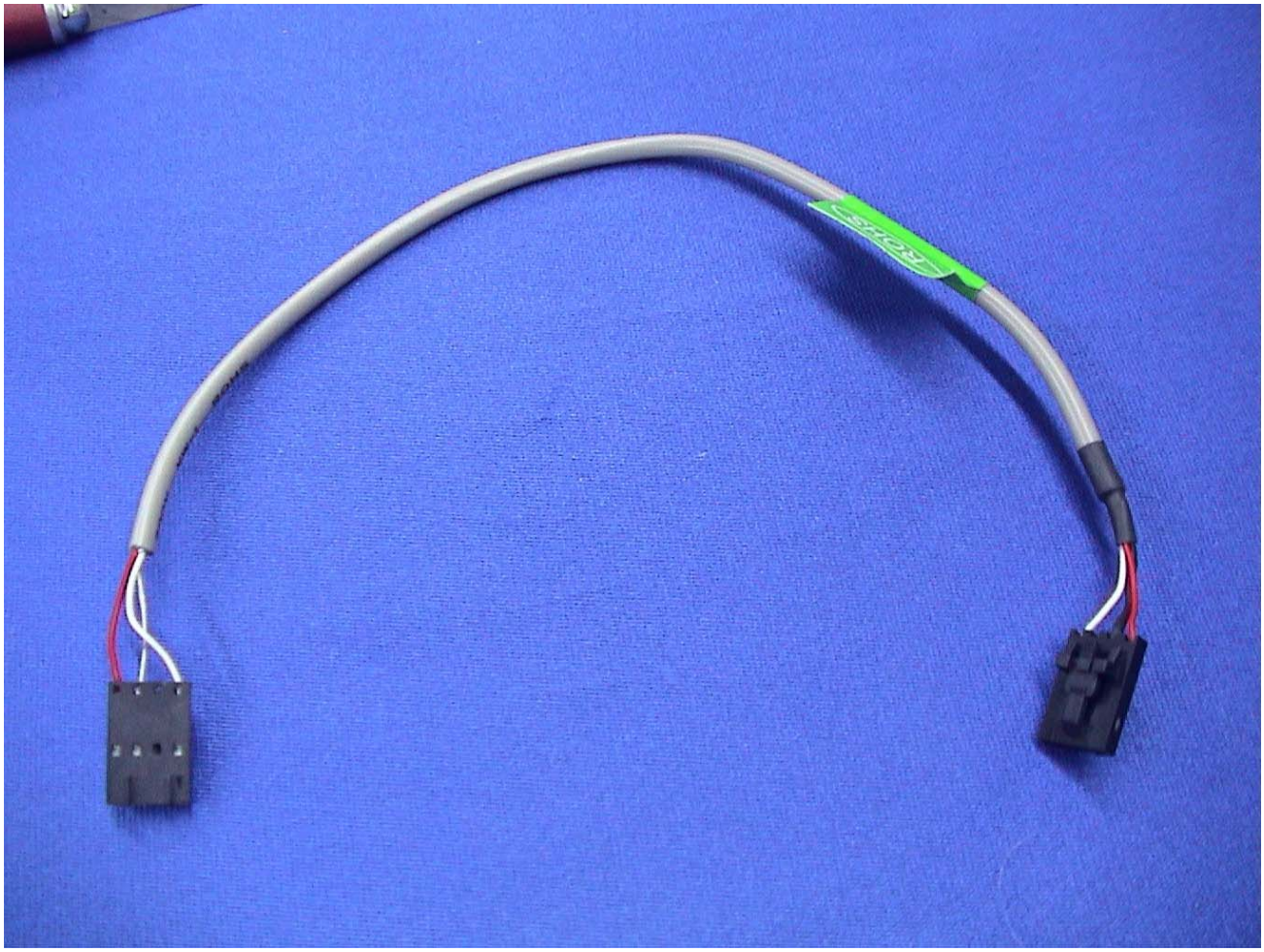

Figure 41 - Finished Cable

Pinouts

MP2CP Pinout

See previous photos for locations.

Connector	Pin #	Name	Function	MP2 User Guide
Z2/Z1	1	Z1/Tog/Mac2	Multifunction	Page 23 - 27
	2	Common for Pin 1&4		
	3	Common for Pin 1&4		
	4	Z2/Res/ZTO	Multifunction	Page 23 - 27
GO2/STRT	1	Start	Start machine	Page 18 - 19
	2	Common for Pin 1&4		
	3	Common for Pin 1&4		
	4	Goto/Mac2	Multifunction	Page 23 - 27
PAUS/STP	1	Pause (Feedhold)	Pause (or Feedhold) machine	Page 18 - 19

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	2	Common for Pin 1&4		
	3	Common for Pin 1&4		
	4	Stop (not e-Stop)	Stop (not e-Stop) machine	Page 18 - 19
MODLEDS	1	IncrLED		Page 19 - 21
	2	Common for Pin 1&4		
	3	Common for Pin 1&4		
	4	FastLED		Page 19 - 21
LED3MOD	1	LED3 (future use)	Not Used by MP2	Future Use
	2	Common for Pin 1&4		
	3	Common for Pin 1&4		
	4	MOD	Mode select (ThumbStick PB)	Page 19 - 21
DUALLED	1	Red LED	disabled mode & ZTO errors	Page 17 - 18
	2	Return (not Ground)		
	3	Return (not Ground)		
	4	Green LED	Shows enabled and activity	Page 17 - 18
ZTO	1	Piezo Switch (touchoff)	Switch that detects touchoff	Page 36 - 43
	2	Common for Pin 1&4		
	3	Common for Pin 1&4		Page 36 - 43
	4	“Cable Inserted” Detect	Checks that ZTO cable is connected to MP2	
YAXIS	1	Same as “Up Arrow”	Moves axis “North”	Page 12, 19-22
	2	Common for Pin 1&4		
	3	Common for Pin 1&4		
	4	Same as “Down Arrow)	Moves axis “South”	Page 12, 19-22
XAXIS	1	Same as “Left Arrow”	Moves axis “West”	Page 12, 19-22
	2	Common for Pin 1&4		
	3	Common for Pin 1&4		
	4	Same as “Right Arrow”	Moves axis “East”	Page 12, 19-22
ROTSW	1	Selector Switch CCWend	Connects to Remote RotSw	Page 13, 22-27
	2	Selector Switch Wiper		
	3	Selector Switch Wiper		
	4	Selector Switch CW end		

ThumbStick Pinout

See previous photos for locations.

Connector	Pin #	Name	Function	MP2 User Guide

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MODELEDS	1	IncrLED		Page 19 - 21
	2	Common for Pin 1&4		
	3	Common for Pin 1&4		
	4	FastLED		Page 19 - 21
MODELED3	1	LED3 (future use)	Not Used by MP2	Future Use
	2	Common for Pin 1&4		
	3	Common for Pin 1&4		
	4	MOD	Mode select (ThumbStick PB)	Page 19 - 21
DUALLED	1	Red LED	disabled mode & ZTO errors	Page 17 - 18
	2	Return (not Ground)		
	3	Return (not Ground)		
	4	Green LED	Shows enabled and activity	Page 17 - 18
YAXIS	1	Same as “Up Arrow”	Moves axis “North”	Page 12, 19-22
	2	Common for Pin 1&4		
	3	Common for Pin 1&4		
	4	Same as “Down Arrow)	Moves axis “South”	Page 12, 19-22
XAXIS	1	Same as “Left Arrow”	Moves axis “West”	Page 12, 19-22
	2	Common for Pin 1&4		
	3	Common for Pin 1&4		Page 12, 19-22
	4	Same as “Right Arrow”	Moves axis “East”	

Remote Selector Switch

See previous photos for locations.

Connector	Pin #	Name	Function	MP2 User Guide
ROTSW	1	Selector Switch CCWend	Connects to Remote RotSw	Page 13, 22-27
	2	Selector Switch Wiper		
	3	Selector Switch Wiper		
	4	Selector Switch CW end		

Mounting Layouts

Below are drawings of the layouts for mounting the MP2CP, ThumbStick, and Remote Rotary Switch Option. These drawings are to show you the basic shape and may not be to scale if you print them out. I would strongly suggest you check our website for the files in several formats (DXF, VCarve, PDF, Corel) and download the proper one that you can import to your CAD software. They are located at:

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www.texasmicrocircuits.com/Files/LayoutFiles.zip

There are all 3 boards (MP2CP, ThumbStick, and Remote Rotary Switch) in VCarve, DXF, PDF, EPS, AI and in several flavors. If anyone has problem with Zip files, please email me and I will send you the individual files. I'll continue to add to the Zip file and post any updates on the Yahoo Group at:

http://tech.groups.yahoo.com/group/TMCCNCPendant/

MP2CP

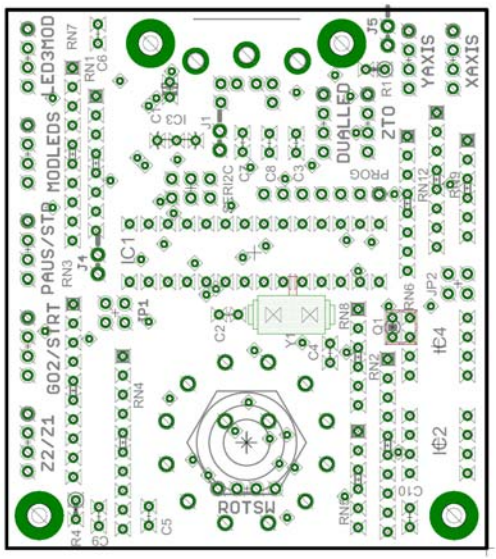

Figure 42 - MP2CP Board Layout Example

ThumbStick

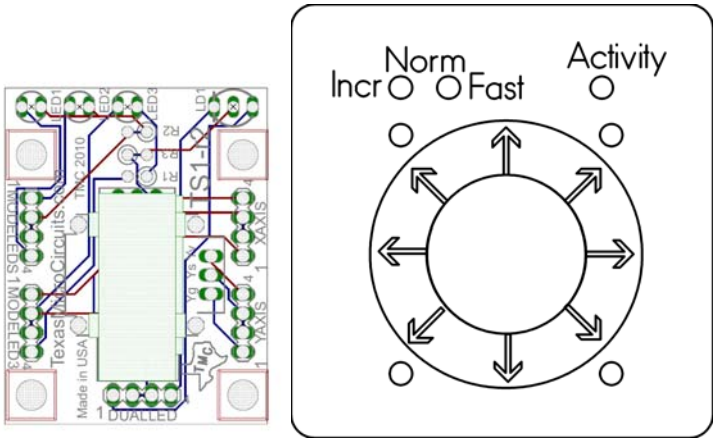

Figure 43 - ThumbStick Board and Layout Example

Below is a copy of the schematic for the ThumbStick PCB. It is wired as a "analog input" type of circuit and that it only takes two analog channels to read the X and Y position of the joystick. This

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lets us have the possibility (in the future) of using it for proportional control but for the current firmware it acts like 4 switches. You'll notice that R2 (current limit resistor for both green LEDs) is shorted on the pcb. Also R3 (current limit for both sides – red/green – of the Dual LED) is also shorted. The reason for this is simple. The current resistors for these LEDs reside on the MP2CP pcb (RN1C and RN6C respectively) and are what limit the current to the LEDs when using the MP2CP with the TS1 (ThumbStick pcb). There are 2 reasons for this engineering design.

1. Someone buys our MP2CP and doesn't want to use out LEDs but wants to mount their own and drive them. We provide the current limit resistors on the MP2CP to make it easy for him to just connect his LEDs to our 4 pin MODELED and DUALLED connector and be done.
2. There is a possibility that someone would like to purchase a ThumbStick for some application and NOT use our MP2CP. Maybe they have there own pendant controller but want to use our ThumbStick pcb for their navigation mechanism. We provide the current limiting resistors on the ThumbStick pcb, but he will have to cut the shorting jumper between them to enable them. This makes it easier to use. The only exception is the 3rd green LED. If used as a 3rd LED in the system, the current limiting resistor is located (and active) on the Thumbstick PCB. If the 3rd LED is NOT used (and not populated), then in a future configuration, the port bit that drives that 3rd LED can be used a switch input for additional features to be announced.

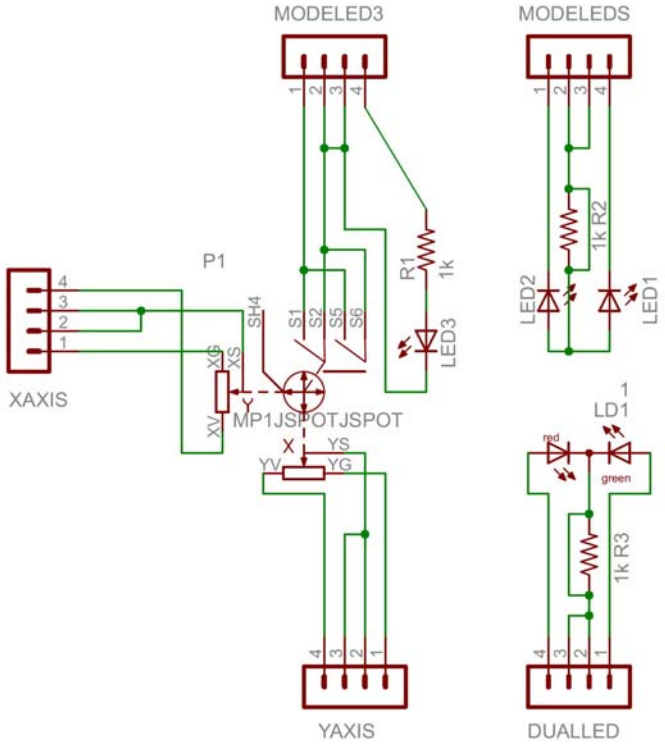

Figure 44 - ThumbStick Schematic

LED Installation on ThumbStick PCB and Panel Mounting

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The LEDs on the ThumbStick pcb were left unsoldered because the height that they are soldered above the pcb depends on the thickness of the top panel and the spacing that occurs between the knob and the top panel. So it was left for the DIY user to solder in the LEDs once the Thumbstick is mounted to the top panel. A few photos below and some explanation should help make this go pretty smoothly. First we get the ThumbStick knob to top panel spacing correct. Supplied with each ThumbStick kit are a set of spacers (4 1/32" red ones, and 4 1/64" gray ones). Depending on your panel thickness and the tolerances on the nylon standoffs, you may need to use these spacers. It will all depend on your mounting and panel. Once you drill the holes for mounting the ThumbStick, mount the standoffs like the photo below. I find that this is easier than mounting them on the ThumbStick first. I'm using a little example panel here that is 1/16" engraving plastic/. Your panel may be up to 1/8" thick. Let me know if you need thicker screws than what was sent in the kit. I also guessed that I might need the 1/64" (red) spacers so inserted them.

Figure 45 - Mounting Standoffs on Panel

Now lay this aside and lets get our LEDs in the holes and oriented correctly.

Note: There was a problem with the silkscreen on the ThumbStick pcb being incorrect (my fault) and the following photos show the CORRECT way to orient the LEDs. Each LED has a "flat" side on the plastic housing. It also has different length leads. You can use either of these to orient the LEDs in the holes. The photos show installing all 3 green LEDs but you only need the outside 2 for use with Mach3. The 3rd LED is a future feature that is more geared toward those that will be using Linux in the future.

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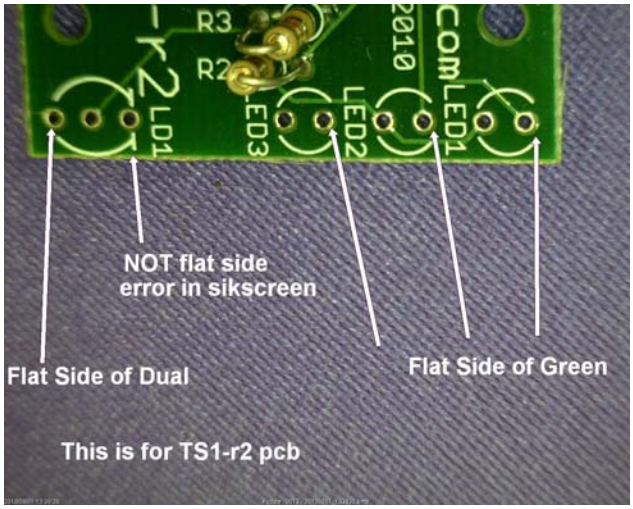

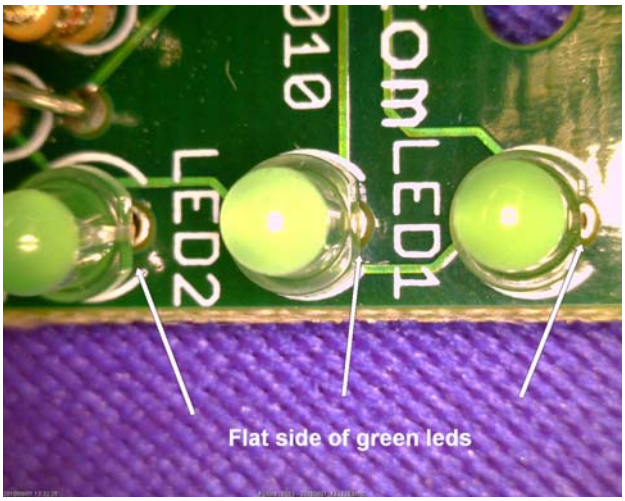

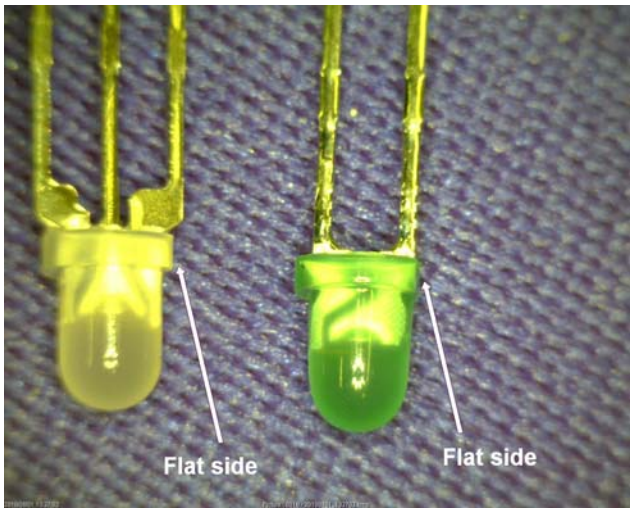

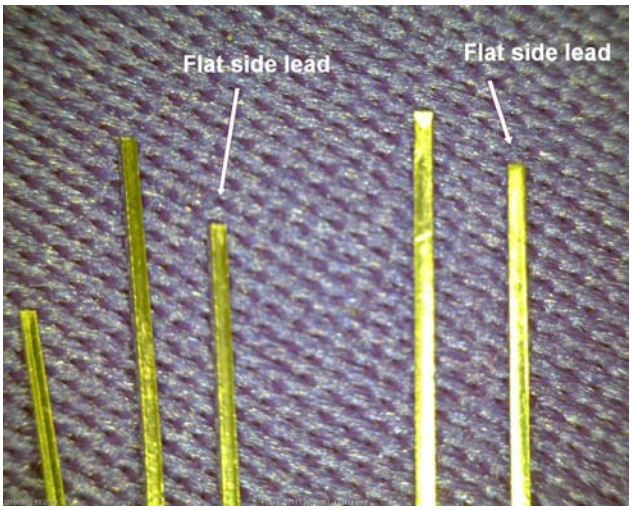

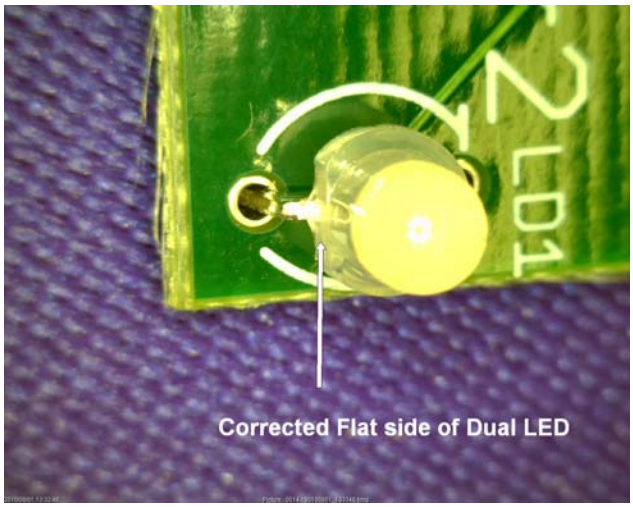

Figure 46 - LED Orientation on ThumbStick PCB

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Now that we know which way to insert the LEDs, put the ones you want to install in the board. Push them down until they are touching (or almost touching) the pcb like the photo below.

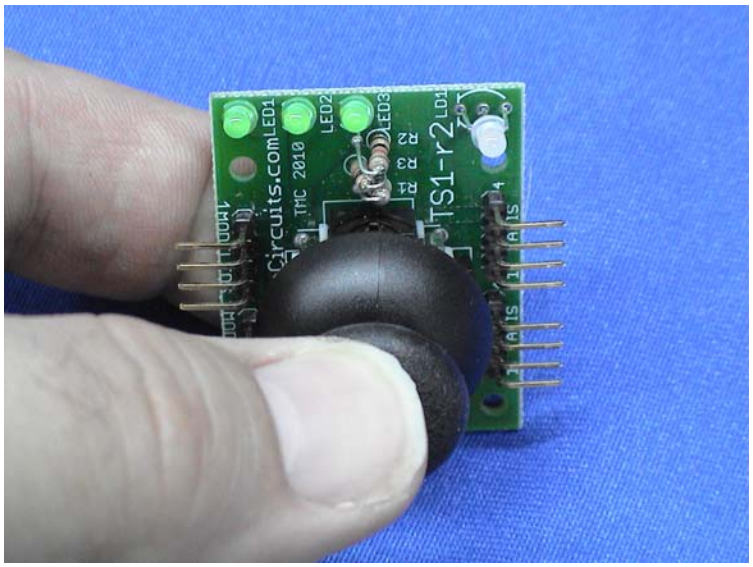

Figure 47 - Inserting the LEDs

Now attach the ThumbStick PCB to the panel with the 4 4-40 nuts like the photo below.

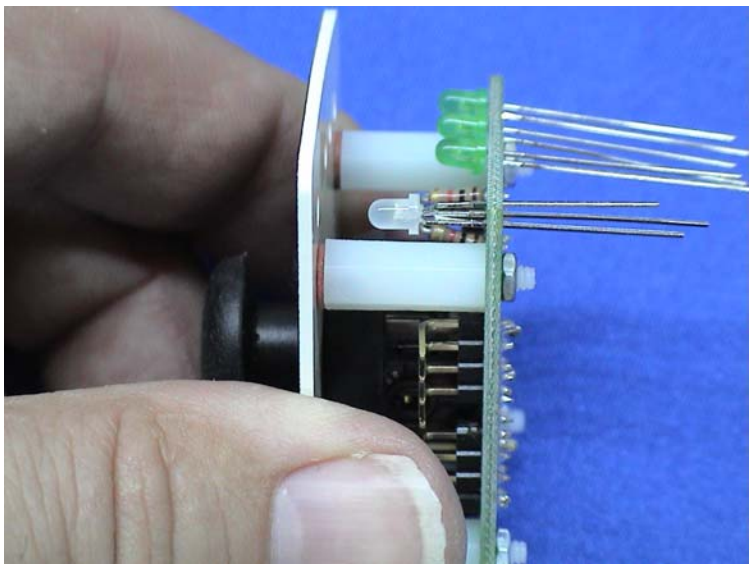

Figure 48 - Mounting the PCB to the Panel

Now is the time to check for “daylight” between the knob and the panel bottom. The idea is to have as little “daylight” as possible, yet a smooth movement (no dragging) of the knob on the panel. See photo below for “daylight” (blue).

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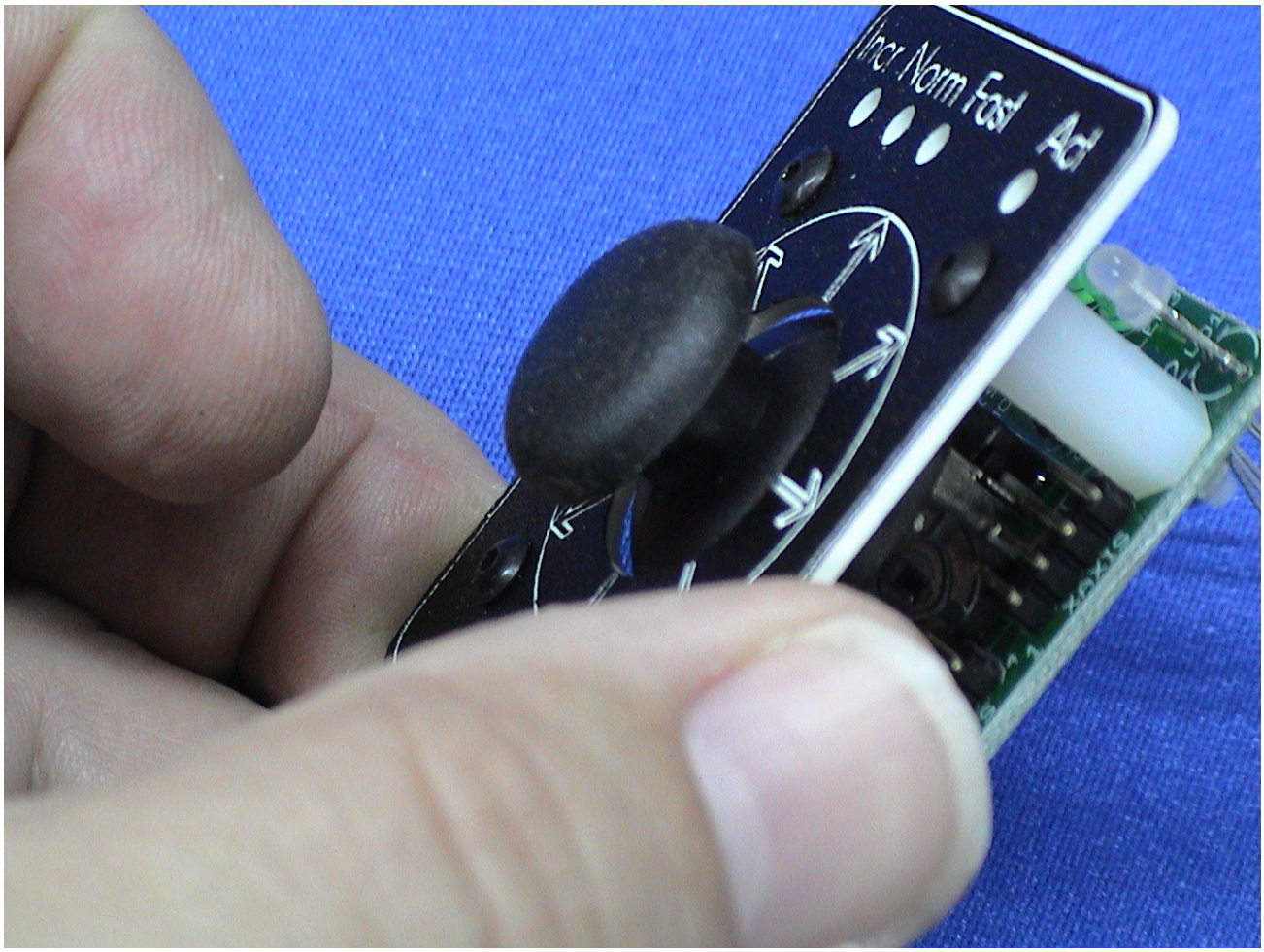

Figure 49 - Checking Spacing for "Daylight"

Add or subtract spacers to get it as you would like. Once you are happy with the operation then push the LEDs up into the panel. Make sure they are pushed up until the lip touches the bottom of the panel as in the photo below.

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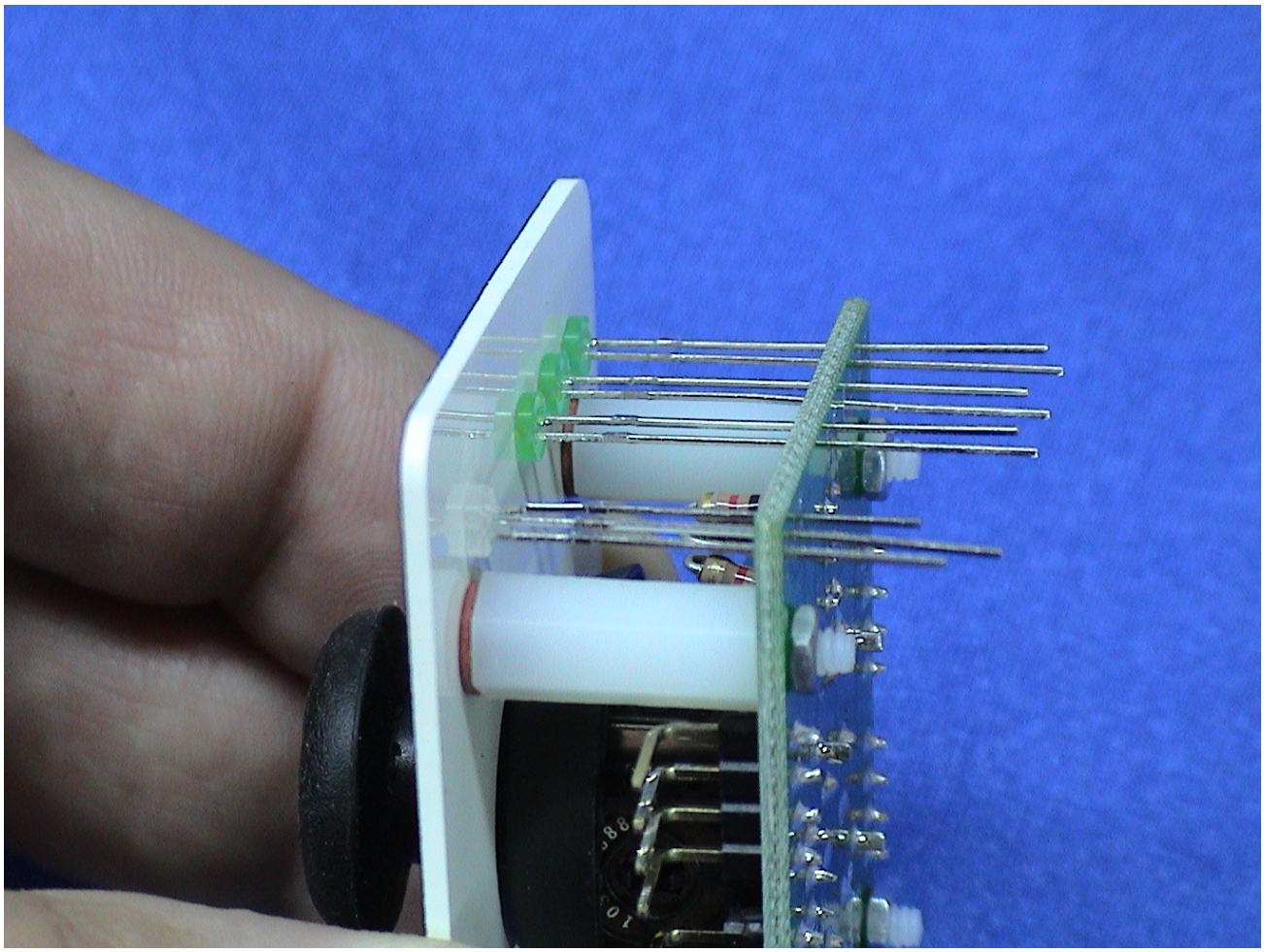

Figure 50 - Pushing the LEDS into Place

Now you are ready to solder the LEDs on the PCB. Once soldered, clip the excess leads of the LEDs off. This should complete the installation of the ThumbStick to your panel.

Remote Rotary Switch

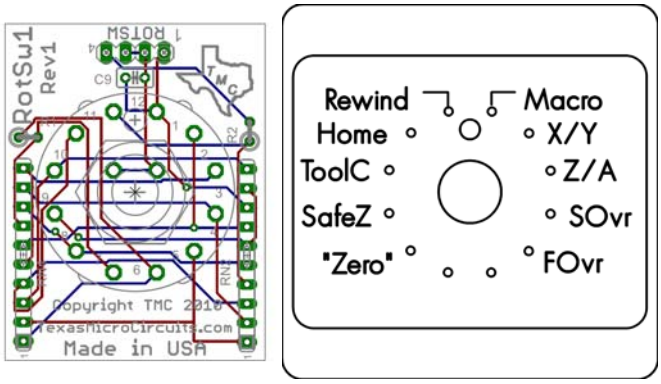

Figure 51 - Remote Rotary Switch and Layout Example

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Below is a copy of the schematic for the Remote Rotary Switch PCB. It is wired as a “resistor ladder” type of circuit so that it only takes one analog channel to read the position of the switch instead of 12 port bits.

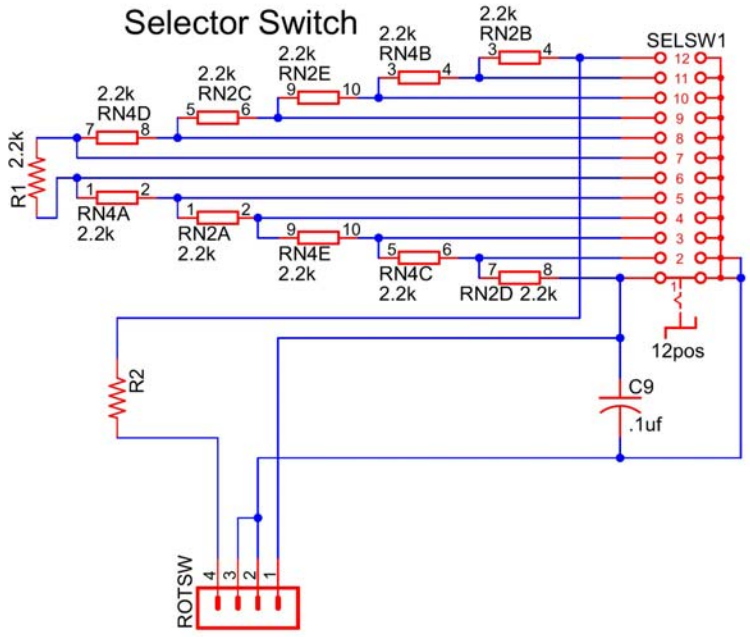

Figure 52 - Remote Rotary Selector Switch Schematic

The Enhanced Mounting Hardware Kit

This kit is an option (and also part of all of the combo offerings). It is not necessary for all of the DIY kit enclosures, but it certainly worth having if you think you might need some longer screws, or the extender shaft for the Rotary Selector Switch, or some longer or shorter standoffs. We provide sources for all of these parts below, but if you need more than a couple of the “extras”, by the time you go to all the sources and pay for shipping from each one, you might have saved a few bucks if you had gotten it from us. We just offer it as a convenience to our customers.

Source Part List for the Enhanced Mounting Hardware Kit

Part	P/N	Source	Link
Panel Bearing	534-1705	Mouser	Mouser.com
Extra Hex Nut for Rotary Switch	534-1456	Mouser	Mouser.com
.250” Nylon Standoffs	839-0843	Allied	Alliedelec.com
.500” Nylon Standoffs	839-0842	Allied	Alliedelec.com
Shaft Coupling .250”	839-1091	Allied	Alliedelec.com
4-40 nuts	90480A005	McMaster-Carr	Mcmaster.com
4-40 lock washers	91113A005	McMaster-Carr	Mcmaster.com
4-40 buttonhead 5/16”	97763A302	McMaster-Carr	Mcmaster.com
4-40 buttonhead ½”	97763A104	McMaster-Carr	Mcmaster.com

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Rotary Selector Switch and Shaft Coupler, Panel Bearing and Extender

We have been using 2 sources for our Rotary Selector Switch. The only difference is that one of the switches has a long shaft (1") and has the serrated end on it so you can use a knob with serrated or splined coupling. We generally cut the shaft to length for our MP2 and put a standard ¼" knob on it. The other is made by the same company and is basically the same 2-12 position switch but it has a ½" shaft on it. The one with the longer shaft we get from Australia (via Thailand) because, at first glance, it is cheaper yet the same quality, however by the time we get it shipped to our lab and pay for customs, etc., the price is not that much cheaper. That coupled with the longer and varying time in which we receive the switches has made us look for it in the US. Mouser seems to be the only source and their version only has the ½" shaft which is still fine for our MP2 pendant.
So we are starting to use the ½" shaft ones from Mouser because they are easier and more reliable to acquire, even though they are a bit more expensive. That brings us to the next topic. We wanted to provide the ability to extend the shaft on the rotary switch (especially the ones mounted to the top of the MP2CP) for those DIY users who have a relatively deep enclosure and mount their MP2CP on the bottom of the enclosure. They then nee to extend their Rotary Selector Switch shaft a distance to come through the top panel and then mount the knob. We provide, in the Enhanced Hardware Mounting Kit, a shaft coupler, a 2" machined aluminum shaft, and a high quality panel bearing to make this extension smooth and a professional look and feel. Sources for these parts are in the chart above. We can provide longer aluminum shafts as I buy them in 6 foot lengths and cut them off with my lathe, but you can just as easily trim the 2" one shorter with a fine tooth saw or tubing cutter. Below are some photos showing another "flexibility" feature we provided in the MP2CP kit for those that have deeper enclosures. Unless I'm missing something, the shaft extender would only be used on the "Top Mounted Rotary Switch" MP2CP model. It's a moot point on the other 2 models.

We also provide the sources if you want to acquire more Rotary Selector Switches for some reason.

Sources for the Rotary Selector Switches

Part	P/N	Source	Link
Long Shaft Rotary Sw	ROTP1P10	Futurlec	Futurlec.com
Short Shaft Rotary Sw	105-SR2612F-12-21RN	Mouser	Mouser.com

By the way, add Futurlec to your list of good places to get parts and boards, etc. at really good prices if you don't mind the wait. It can take 3 weeks for regular delivery which they send in bulk to New York and ship from there. You can pay more and get them quicker, but it can be pricey. They have a lot of cool stuff. Check out their website.

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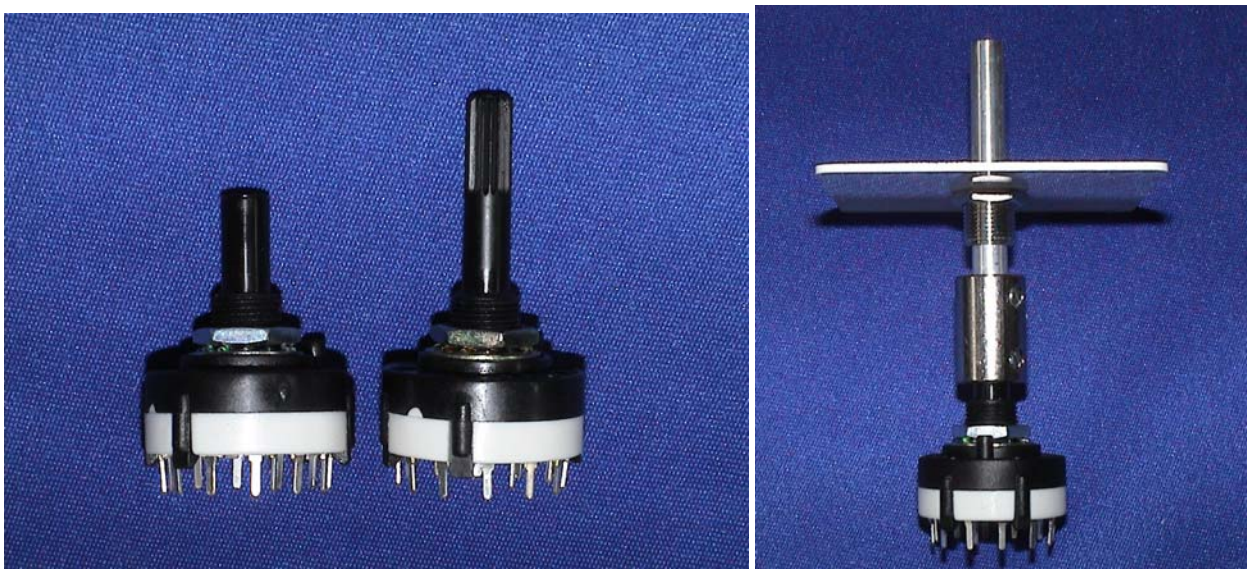

Figure 53 - Rotary Selector Switches & Shaft Extender

Sources for Parts Used in the MP2 MiniPendant

Though part of the reason we were able to provide a low cost DIY pendant kit was that we did not supply many of the more expensive parts or the "expensive" labor to make the pendant. Many DIY guys have their "junk" boxes as well as their surplus sources for much less expensive (yet high quality) parts for their pendant. I had planned to publish my source(s) for the parts that the DIY user has to acquire in case he wants to use exactly what we sue in the MP2. Here is that list. For many of the parts, I only used one source. The price changes too frequently so I won't list the current price. You can go to their website and type in the part number and see what the going rate is.

Source Part List for the MP2
(This table is a reference to parts used in the MP2 and not all can be used with the MP2CP – i.e. B1-120BL enclosure is too small)

Part	P/N	Source	Link
Red "Stop" Switch	612-RP3502MA-RED	Mouser	Mouser.com
	EG1938-ND	Digikey	Digikey.com
Green "Start" Switch	612-RP3502MA-GRN	Mouser	Mouser.com
	EG1934-ND	Digikey	Digikey
Yellow "Pause" Switch	612-RP3502MA-YEL	Mouser	Mouser.com
	EG1936-ND	Digikey	Digikey.com
Black Switch	612-RP3502MA-BLK	Mouser	Mouser.com
	EG1932-ND	Digikey	Digikey.com
Rotary Switch	105-SR2612F-12-21RN	Mouser	Mouser.com
High Quality Rot SW Knob	506-PKAP70B1/4	Mouser	Mouser.com
Extruded Alum Case	B1-120BL	Box Enclosure	Boxenclosures.com
	278-0265	Allied Electronics	Alliedelec.com
	26K8995	Newark	Newark.com
ThumbStick	774-252A103B60NB	Mouser	Mouser.com

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USB Adapter	SW-7505	Sewell	Sewelldirect.com

Mounting the Remote Rotary Selector Switch

This mounting is simple as shown in the photo below. If you use the 1/8" "key" hole (recommended), you need to move the lock washer to the top of the panel. If you don't want to use the "key" hole, then the lock washer should be left on the bottom of the panel.

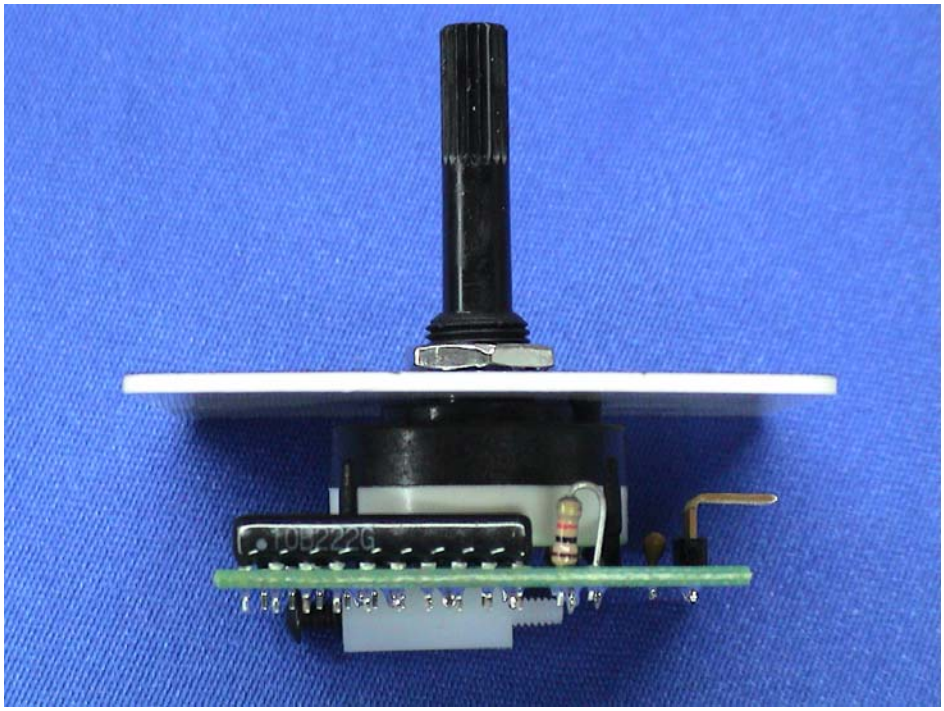

Figure 54 - Installing the Remote Rotary Selector Switch

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Mounting the MP2CP

Mounting the “Top Mounted Rotary Switch” MP2CP

The top mounted rotary witch model is mounted with 4 standoffs as shown in the photo below. The hole pattern is located in the “Mounting Layouts” section shown earlier in this document. See example photo below.

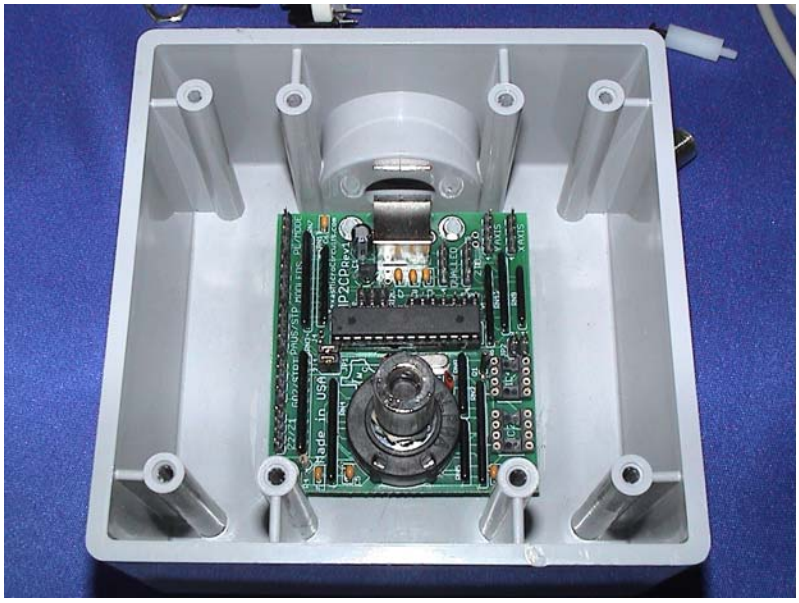

Figure 55 - Mounting the Top Mounted MP2CP

Mounting the “Bottom Mounted Rotary Switch” MP2CP

The bottom mounted rotary witch model is mounted with 4 standoffs and the Rotary Selector Switch as shown in the photo below. The hole pattern is located in the “Mounting Layouts” section shown earlier in this document. See example photo below.

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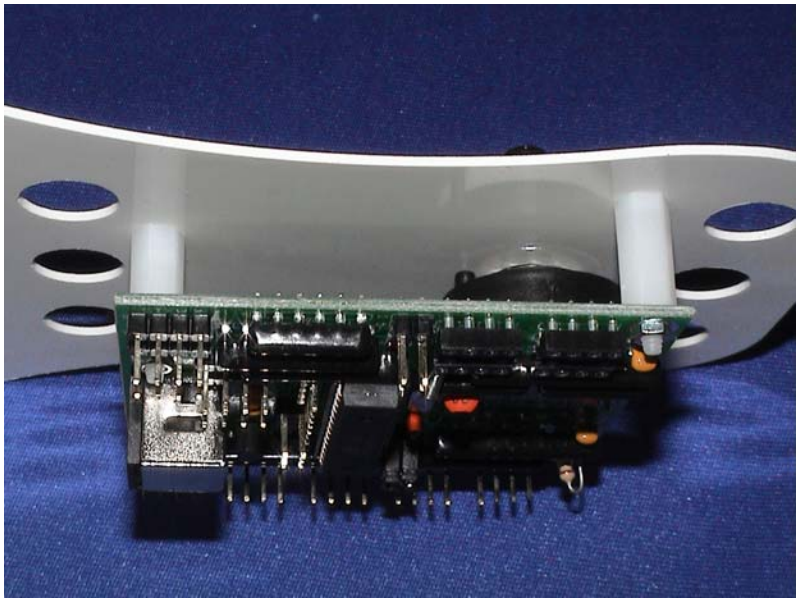

Figure 56 - Mounting the Bottom Mounted MP2CP

Differences between Rev 1 and Rev2 of the MP2CP PCB

You may have noticed in some of the conversations on the user group (Yahoo group TMCCNCPendant) that there is a Revision 1 (Rev1) and a Revision 2 (Rev2) MP2CP PCB. This happens in all engineering projects when something is "fixed" or something is added and a new "rev" of the board is produced. Rest assured if you have a Rev1 pcb that your board is functionally equivalent to the Rev2 boards and here are the differences (they are minor).

- The Rev2 board supports the Remote Rotary Switch Option by adding a 4 pin header in the middle of where the Rotary Switch would have mounted on the PCB. If you have and Top or Bottom mounted switch pcb, then this is a moot point
- I changed some text on one of the 4 pin headers. One the Rev1 board, the text reads "PL/MODE" and on the Rev2 board the same 4 pin header reads "LED3MOD". See the photos below.

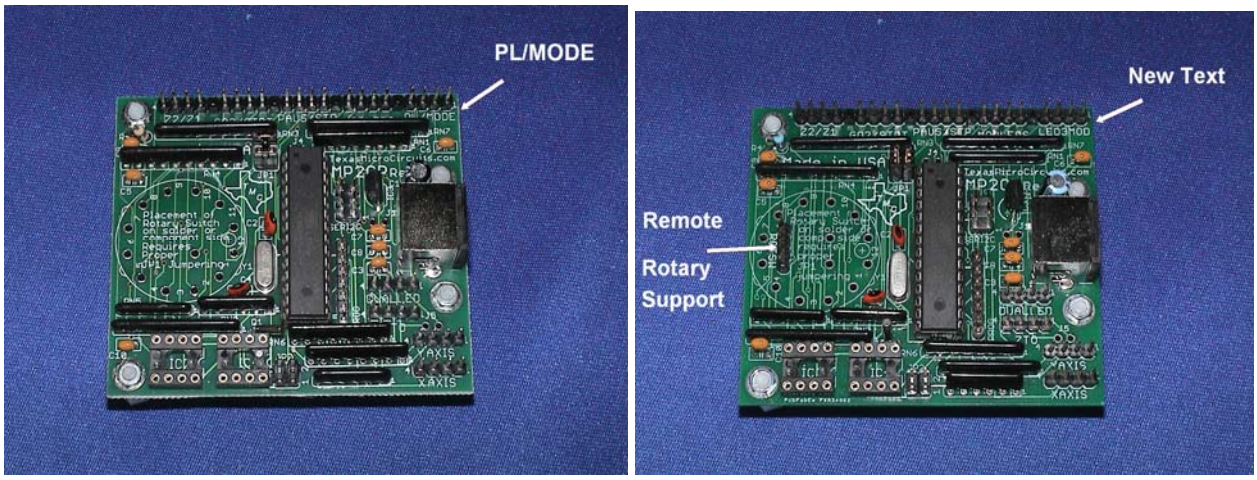

Figure 57 - Rev1 PCB and Rev2 PCB

That's it. Nothing else changed.

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To Be Added:

- Give information on where to get engraver bits, etc. for engraving front panel
- Give a short tutorial on Avery Design and panel creation
- Explain how you can use larger LEDs (or brighter LEDs) and how to change the limit resistor circuit by adding a resistor to J4 or J5 on the MP2CP.
- Show cable to cable connection for MP2CP and ThumbStick as well as Remote Rotary Switch.

Hardware Installation

Note: It is assumed that you have built your custom DIY MP2CP pendant to be electrically equivalent to our MP2. That means that you have wired the necessary pushbutton switches and some form of navigation (compass pushbuttons, switch joystick or our ThumbStick option) per the pinouts we have provided above. This being the case, your pendant is functionally equivalent to our MP2 minipendant.

Installation of the MP2CP was designed to be quite easy. Even though the MP2CP is a "keyboard emulator" device and uses a keyboard cable, it is recommended to be connected to the Mach PC through a USB port using the supplied USB adapter.

USB port

Most (if not all) PCs that meet specifications to run the Mach software will have integrated USB ports. A USB hub can also be used. Below is a typical USB port located on the rear of the PC.

Figure 58 - Typical USB Port

USB Adapter

The supplied USB adapter is used to connect the MP2CP to the PC. This is an "active" USB adapter which means it has microcontroller electronics inside to translate the keyboard signals to USB signals. This USB adapter has been extensively tested with the MP2CP and produces excellent results. It is the only adapter supported for this application.

The first time the USB keyboard adapter is plugged into the PC, Windows (2000, XP or Vista) will automatically install the USB adapter and the message "**Found New Hardware**" will appear. Once Windows finishing installing the adapter, you **may** get a message to reboot. This will only happen

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the first time you plug the adapter in a new USB port. **There are no special drivers or additional software to install for the MP2CP**.

Figure 59 - USB Keyboard Adapter

Keyboard Cable

The 10 foot PS/2 keyboard cable is a male-to-male cable, and it comes attached to the MP2CP. The supplied cable may be replaced by a cable up to 25 feet, if needed. Longer cable lengths are not supported.

Figure 60 - Male-2-Male Keyboard Cable

USB Extender (Optional)

Because it is wider than a USB cable connector the supplied USB adapter can cause adjacent USB ports to become inaccessible, (see photos below). A USB extension cable is supplied to use if required. This extension cable will help move the USB adapter away from the tightly grouped USB ports for better access.

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Figure 61 - Crowded USB Port

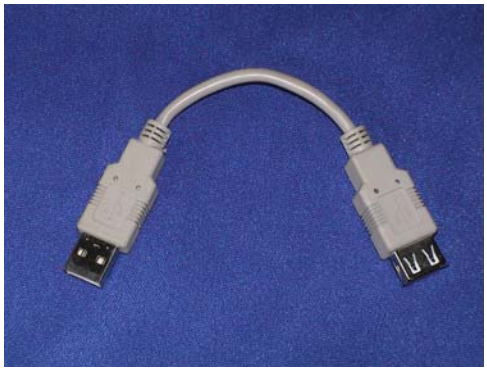

Figure 62 - USB Extender

Software Installation

There is **no** software installation. As mentioned earlier, the first time the USB adapter is plugged into a USB port on the PC, Windows (2000, XP, or Vista) will recognize the adapter and a message ("**Found New Hardware"** will appear on the screen. It **may** require a reboot of the PC this first time. **There are no special drivers, applications, macros, or scripts to load to be able to operate the MP2CP or ZTO.**

Note: Some of the functions such as SafeZ, Tool Change (ToolC), and Reset Spindle Speed Override, required the Mach support team (mainly Brian Barker) to add, adjust or correct these functions in Mach. To be able to access all of the functions in Mach, you must use the latest version (**R3.042.020 or later**).
If you are running an older version of Mach and don't want to upgrade, most of the MP2CP functions are still operational.

Operation

The operation of the MP2CP and Z-axis Touch-Off (ZTO) are explained in detail below.
In addition, demonstration videos have been produced and are included on the CD you received with your MP2CP. These are also located on our website at:

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Power up

When the MP2CP is plugged in to the USB port, the pendant powers up in disabled mode.
Note: The Stop and Pause buttons are active even when the pendant is disabled.

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The pendant then slowly flashes the Status LED **red**. This indicates that the pendant is disabled. This disabled mode prevents unintended joystick or pushbutton activity.

Pendant Enable/Disable

Pressing the Joystick button down and holding for a minimum of 1 second will turn the Status LED from a flashing **red** to a solid **green**. This indicates that the pendant is enabled and the joystick and pushbuttons are active.

Note: If you did not use our Thumbstick in your navigation pendant design, you must connect a pushbutton switch to the “Mode” switch connection in order to enable the pendant for operation. Our ThumbStick option uses the built in joystick button to enable (and disable) the pendant.

Pressing the Joystick button down and holding for a minimum of 2 seconds will turn the Status LED from a solid **green** to a slowly flashing **red** indicating that the pendant, once again, is disabled.

During the time that the pendant is enabled, any activity on the joystick, pushbuttons, or Function Selector Switch will keep the pendant enabled.
If there has been no activity on the pendant for 9 minutes, the pendant will start to toggle the Status LED green and red. This indicates that in 60 seconds, if no activity, then pendant will enter the disabled mode.

After a total of 10 minutes of inactivity, the pendant will enter the disabled mode.

Figure 63 - Enabling the Pendant

Start/Pause/Stop Pushbuttons

The Start, Pause, and Stop pushbuttons perform simple but very important functions on the MP2CP The Start pushbutton is operational any time the MP2CP is enabled. The Stop and Pause pushbuttons are operational at all times, even when the pendant is disabled.
Note: your pushbutton layout may look different than our MP2, but should be functionally the same.

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Figure 64 - Start/Pause/Stop Pushbuttons

Start (Cycle Start)

The Start pushbutton is the same as Cycle Start on the Mach screen.
Pressing Start performs the same as pressing the <Alt>R on the keyboard.

Pause (Feed Hold)

The Pause pushbutton is the same as Feed Hold on the Mach screen. It is **ALWAYS** operational, even when the pendant is disabled.
Pressing Pause performs the same as pressing the spacebar <space> on the keyboard.

Stop (not E-STOP)

The Stop pushbutton is the same as Stop on the Mach screen. It is **ALWAYS** operational, even when the pendant is disabled.
Pressing Stop performs the same as pressing <Alt>S on the keyboard.
The Stop pushbutton is **not** the same as the E-STOP switch.

Jogging Modes

Before we discuss the axis operation of the joystick, we'll cover the jogging modes of the MP2CP. Anytime the MP2CP becomes enabled, it enters the Normal jogging mode. A press of the joystick button cycles the MP2CP to the next mode.
The cycle is Normal > Fast > Incremental > Normal, etc.

Warning: If the joystick button is held pressed for 2 seconds or more, the MP2CP will enter the disable mode. A simple press of the joystick button is all that is required to change modes.

Normal Jogging Mode

When the MP2CP is in Normal jogging mode (both green LEDs are lit), movement of the joystick will shift the appropriate axis at "Slow Jog Rate" speed as set in Mach. The normal mode speed is the same as pressing the arrow keys (for the X/Y axes), PageUp/PageDown (for the Z axis), or the semicolon (;) / single quote (') for the Aux axis. This "Slow Jog Rate" speed is set in Mach.
For more on these keyboard hotkey equivalents, see the next section: **Joystick and Axis Movement**.

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Note: Our MP2 only uses 2 of the 3 available green LEDs to show jogging mode. The 3rd LED is for future use. Should you connect it, it may light but will not show anything of importance at the present time. We will announce its function in the next Digital Machinist article in the Fall of 2010.

Figure 65 - Normal Mode (both LEDs on)

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Fast Jogging Mode

When the MP2CP is in Fast jogging mode (only right green LED is lit), movement of the joystick will shift the appropriate axis at the fast speed as set in Mach. The fast mode speed is the same as holding down the <shift> in addition to the current keyboard key (arrow keys, Page Up, Page Down, etc.) that move the axis.
This “Fast Jog Rate” speed is set in Mach.
For more on these keyboard hotkey equivalents, see the next section: **Joystick and Axis Movement**.

Figure 66 - Fast Mode (right LED on)

Incremental Jogging Mode

When the MP2CP is in Incremental (Incr) jogging mode (only left green LED is lit), movement of the joystick will shift the appropriate axis at the incremental speed as set in Mach. The incremental mode speed is the same as holding down the <ctrl> in addition to the current keyboard key (arrow keys, Page Up, Page Down, etc.) that move the axis.
This “Incremental Jog Rate” is set in Mach.
For more on these keyboard hotkey equivalents, see the next section: **Joystick and Axis Movement**.

Figure 67 - Incremental Mode (left LED on)

Troubleshooting

First thing to do is some problem isolation. See the block diagram of the Pendant/Mach system below.

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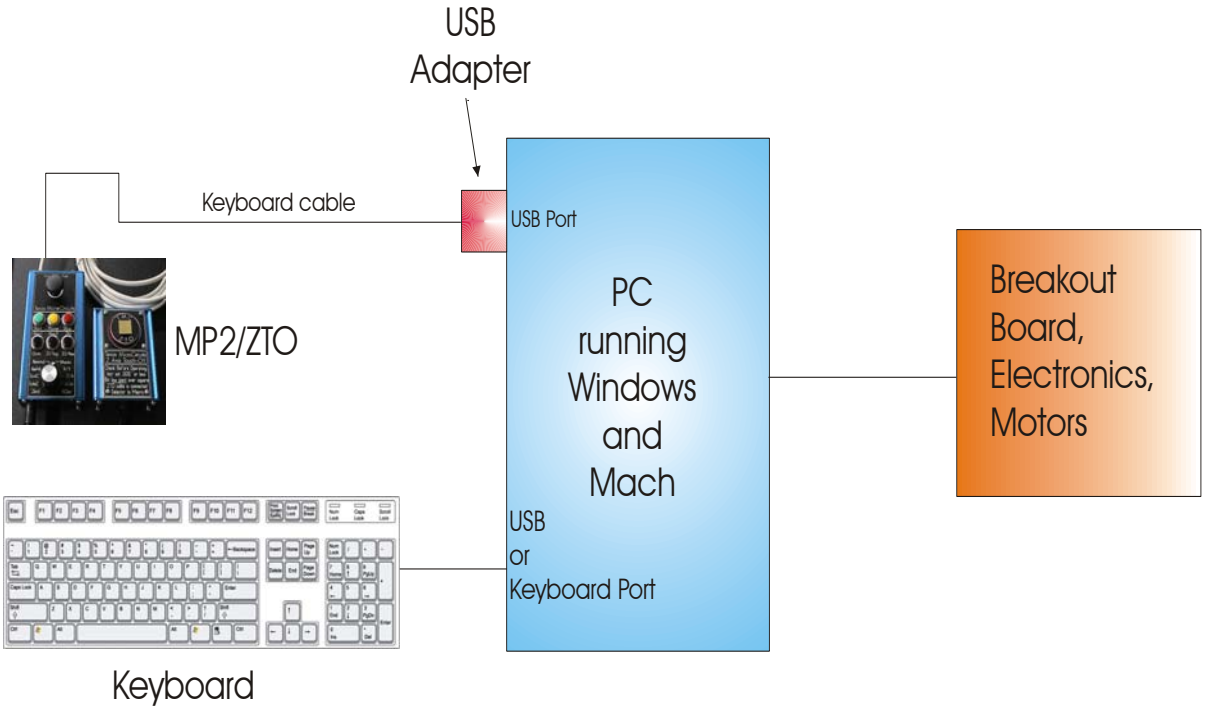

Figure 27 - Pendant/Mach System

Since the MP2CP is a "keyboard emulator", the PC "sees" it as a keyboard….nothing more. Keyboard commands (scan codes) are sent from the MP2CP to the PC through a keyboard to USB adapter. The Mach program running on the PC interprets these keyboard commands and then controls the machine (mill, lathe, router, etc.) through the breakout board, driver electronics, and motors attached to the machine. The exact same keyboard commands can be initiated through the standard keyboard attached to the PC. This gives us 2 places to initiate commands and will help us troubleshoot the problem.

Try a using the MP2CP to control your machine through Mach. Does any command work such as moving an axis or Rewinding a g-code file? If, at least, one command works then we can assume that the electrical path from the MP2CP to Mach is working. If no command works, then we will need to determine if it is a connection or electrical failure, etc. Try a command through the keyboard (arrow keys to move axes, <Ctrl>W to rewind the loaded g-code file, etc.

A good rule to remember: If it doesn't work from the keyboard, it probably won't work from the pendant and you will probably need to change a configuration setting in Mach.

Let's start by moving the X axis with the keyboard. Mach should be on the main screen otherwise click on the tab at the top of the Mach screen "Program Run" or press <Alt>1 on the keyboard. Make sure the button in the lower middle of the screen "Jog ON/OFF Ctrl-Alt-J" is active (green border around it). If not, then click on it with the mouse or press (together) <Ctrl><Alt>J on the keyboard. This should turn jogging on.

Now press the left or right arrow key. The X axis should move in the appropriate direction. If it does not, then refer to "**Jogging Control Family**" in the Mach3Mill manual.

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If pressing the arrow key does move the axis then commands are sent correctly from the keyboard and executed by Mach.

Next enable the MP2CP (see **Pendant Enable/Disable** section under **Operation** earlier in this manual). Point the Function Selector Switch to X/Y. Now, with your thumb, push the joystick to the far left (or right) and you should see the X axis move accordingly. Releasing the Joystick will halt the axis movement. If this axis movement does not work, study the **Installation** section in the manual and make sure you have installed the MP2CP and USB adapter correctly. If it still does not work, please check the Mach forums for any others having the same problems or send an email to support@texasmicrocircuits.com and we will assist you in finding the problem.

Now step though all of the functions of the MP2CP using section "**Selector Switch Functions**" earlier in this manual as a guide. If a function does not perform correctly, then try the keyboard equivalent.

Once again, if it doesn't work from the keyboard, it probably won't work from the pendant and you will probably need to change a configuration setting in Mach.

Check the Mach forums for others using the MP2CP. This is a very good source of help. Also email us with any questions at support@texasmicrocircuits.com .

One last thing. Since you will possibly be operating your machine with the pendant and not looking at the PC screen, make sure you have your power management and screensavers turned off so that if your PC goes to sleep while you are not looking and you are not surprised when the MP2CP doesn't control anything.

Firmware Version

The MP2CP firmware version can be displayed by executing a small procedure:

1. Unplug the MP2CP USB adapter from the PC USB port. This will power down the MP2CP.
2. While holding down the Start button, plug the USB adapter back in to the PC USB port. This will power up the MP2CP
3. All of the LEDs will flash quickly showing that they are working properly. This lasts less than 1 second.
4. Release the Start button.
5. Next the left green LED (Incr) will slowly blink a number of times….count the blinks. This is the major version number.
6. Next the right green LED (Fast) will slowly blink a number of times….count the blinks. This is the minor version number.
7. The number of these blinks will show the current firmware version. Example: The left LED blinks 4 times and the right LED blinks 1 time. The firmware version is 4.1. This sequence will repeat.
8. Pressing the Stop button will return the pendant to the disabled mode and can be operated from there.

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9. Newer firmware versions will be released when they have been developed and thoroughly tested. All firmware updates will be in the form of a new microprocessor that can be replaced in the MP2CP. User replacement of this microprocessor has not been decided as firmware updates may also dictate new component installation inside the MP2CP.

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Frequently Asked Questions (FAQ)

Q: I can't get one/some/any functions to operate from the pendant.
A: Start with the Troubleshooting section above. Note that some functions, as noted on Page 6 of this document, require the recent Mach release (lockdown **R3.042.020** or later) and screen set to function properly.

Q: Can I reprogram hotkey output of the MP2CP?
A: No, not at the present time. However, this is one of the things on our "to do" list. We will be announcing this "reprogram" feature in the next Digital Machinist article in the Fall issue of 2010.

Q: Why does the MP2CP require a USB adapter? Can't I just use the keyboard port?
A: The reliable and **supported** answer is no. The supplied **active** USB adapter consistently supports the MP2CP. In addition to providing a dependable "keyboard emulator" interface, the active USB adapter allows you to "hot plug" the MP2CP whereas most keyboard ports will not.

Q: Can I install a longer keyboard cable?
A: Yes. We supply a standard 10 ft. male-to-male shielded keyboard cable with every MP2CP. We support a keyboard cable up to 25 ft.

Q: Can I install a longer USB cable between the adapter and PC?
A: Yes. However, if you want to add length to the MP2CP, we suggest a longer keyboard cable. USB specifications restrict you to a max USB cable of 5 meters (about 15 ft.). We support keyboard cables up to 25 ft. Also if you add a USB long USB cable between the PC and USB adapter, then the adapter will be hanging out in the middle of the cable set. Electrically this won't be a problem, but mechanically it may move around enough during pendant usage that it comes unplugged. If you secure the adapter to both the cables then this should not be a problem.

Q: Can the MP2CP work in a nasty or wet environment?
A: The MP2CP was not designed to work in a very harsh environment. That said, we have been using it in an environment for months that contains MDF dust, engraving plastic, and aluminum cuttings and we have not had one fail. If it gets dirty, we just vacuum it, and then blow off anything else. Use it anywhere you would use your keyboard. Note: this depends on YOUR implementation of the MP2CP and how it is enclosed. Our MP2 was not designed for harsh environments. You may choose to "harden" your enclosure and make it more "harsh environment" friendly.

Q: Why is the Stop button active when the pendant is disabled?
A: Actually both the Stop and Pause buttons are always active. These are due to safety issues. There were instances where an operator started a new machine operation and kept the pendant in his hand ready to stop the machine if the operation didn't perform as expected. Meanwhile, because there was no pendant activity in the specified time (old time of 2 minutes), the pendant went into disabled mode. Had the operator needed to stop the machine with the pendant, the Stop button would not have functioned. We did 2 things to remedy this:
- We increased the time "with no activity" from 2 minutes to 10 minutes.
- We made the Stop (and Pause) buttons always active, even if the pendant became disabled

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In a future firmware release we plan to make these (and other options) configurable by the operator.

Q: Can my MP2CP be used with the ZTO?

A: Yes. The MP2CP has all of the firmware and connections to support our ZTO. Our ZTO does not yet come in kit form and there is a cable and connector (contact us) to let you use our ZTO with your MP2CP.

Q: I keep getting this "sticky keys" message from Windows?

A: This is a windows option (always turned on) that needs to be turned off. Follow the directions in one of these links to do so. Be sure to disable it in all areas.
http://www.ehow.com/how_4822850_undo-sticky-keys.html
http://www.microsoft.com/enable/training/windowsxp/stickykeys.aspx

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Appendix

First I Want To Thank You!...
….and Then I Want to Protect Your Machine and Tooling.
If you connect our ZTO to your MP2CP, please read on.

I appreciate your choosing the MP2CP MiniPendant 2 Control Processor and Z-axis Touch-Off (ZTO) to help free you from your Mach keyboard and mouse. I expect it to bring you years of reliable service.

BUT....

The other reason this note has been inserted in your MP2CP/ZTO box is to help emphasize the importance of proper setup of the ZTO feature.

If you purchased an MP2CP pendant and ZTO combination, 50% of the setup has been done for you. During manufacture and testing, we set the parameters in the MP2CP to show that you either use the **inch or metric system** in your Mach machine.

We also take the **height of your ZTO module** and put this measurement in the MP2CP. This enables the MP2CP to set the Z-axis DRO in Mach with the height of your ZTO when a touch-off function has been completed.

If you ever need to change these parameters in your MP2CP, there are video clips on the enclosed CD and Texas MicroCircuits website as well as detailed procedures in the MP2CP User Guide to help you change these parameters in the field.
Please refer to them for detailed instruction.

It is very important for the proper and safe operation of your Mach machine as well as the protection of your cutting bits and ZTO module that you check and adjust the other 50% of setup.

The 1st of these checks and adjustments concerns the “Slow Jog Speed” setting of your Mach software.
It is **HIGHLY RECOMMENDED** that you limit the “Slow Jog Speed” to about ***25 ipm (635 mm/min) or less***. You can still use a much higher “fast” jog speed, but keeping the “Slow Jog Speed” about 25 ipm or below will help protect your cutters and ZTO.

The 2nd of these checks and adjustments concerns the “Incremental Jog Setting” of your Mach software.
It is **REQUIRED** that you set your “Incremental Jog Setting” somewhere between 0.001” and 0.005” ***(preferably 0.001” (0.025mm)*** if you want to obtain the accuracy and repeatability you expect.

Please watch the video clips and read the section of the MP2 User Guide that shows you how to check and adjust these settings.

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Adhering to these recommendations and requirements will help prevent you from damaging your machine, tooling, and ZTO module.

Documents and Videos that you should read/watch…and more to come specific to the MP2CP

Documents

MP2/ZTO User Guide in PDF format

The MP2/ZTO User Guide is a detailed operation, technical details, and troubleshooting document. Over 50 photos and drawings are included for ease of understanding the installation, operation, and functions of the MP2 MiniPendant 2 Control Processor and Z-Axis Touch-Off (ZTO).

Videos

MP2 Basic Operation Video

This short video demonstrates the enabling and basic operation of the MP2. This includes the joystick function, jog mode cycle, and Start/Pause/Stop buttons.

MP2 Advanced Operation Video

This short video demonstrates the disabling and advanced operation of the MP2. This includes the operation of each function of the Selector Switch and multifunction buttons that relate to each setting.

MP2 Z-axis Touch-Off (ZTO) Operation Video

This video demonstrates the proper operation of the Z-axis Touch-Off (ZTO) function of the MP2. It also includes "micro video" examples of different types of cutter bits and shows each reacting to the "Z axis Reverse" and "Touch-Off" operation.

MP2 Parameter Setting for the ZTO Video

This short video explains the procedure on the MP2 of setting the stored "inches or mm" and "ZTO height data" into the MP2CP flash memory.

MP2/ZTO Checks and Adjustments to Mach Video

This video goes through the checks and adjustments in Mach for users of the MP2/ZTO combination.

These documents and videos are also available for viewing or download at:

www.texasmicrocircuits.com

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